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HAYWARD (K. J.). **Departamento de Entomología.** [Department of Entomology (Report for 1941 of the Tucumán Experiment Station).]—*Rev. industr. agríc. Tucumán* **32** no. 1–3 pp. 45–55. Tucumán, 1942.

Fruit-flies were major pests in Tucumán, Argentina, in 1941 [*cf. R.A.E.*, A **30** 457], and damage was also done by *Eriosoma lanigerum*, Hsm., to apple and by *Cydia molesta*, Busck, to peach. Coccids observed on unusual foodplants included *Coccus* (*Lecanium*) *hesperidum*, L., on avocado and mango, *Ferrisiana virgata*, Ckll., on mango, *Chrysomphalus dictyospermi*, Morg., on carob [*Ceratonia siliqua*], *Aspidiotus* (*Furcaspis*) *cyanophylli*, Sign., on avocado, *Pseudoparlatoria parlatorioides*, Comst., on litchee, *Litchi* (*Scytalia*) *chinensis*, and *Icerya purchasi*, Mask., on soy bean. Parasites of Coccids included the Aphelinid, *Metaphycus* (*Aphycus*) *flavus*, How., from *Coccus hesperidum*. Potatoes were injured by *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell. [*cf.* **30** 566], about two-thirds of the larvae of which were parasitised, and cabbages by *Epicauta monachica*, Berg, which was very numerous in some districts and also attacks potato, *E. adspersa*, Klug, and cutworms.

Other pests not mentioned in the preceding year's report [**30** 166] included *Heliothis armigera*, Hb. (*obsoleta*, F.) and *Dysdercus* sp. on cotton, the Malachiid, *Astylus atromaculatus*, Blanch., attacking recently sown seeds of cotton and rice, *Elasmopalpus lignosellus*, Zell., on sugar-cane, *Epitrix argentinensis*, Bryant, and *Protoparce sexta paphus*, Cram., on tobacco, *Gymnandrosoma punctidiscanum*, Dyar, on cherimoya [*Annona cherimolia*] and the Danaid, *Lycorella* (*Lycorea*) *cleobaea*, Godt., and the Sphingid, *Pachylia ficus*, L., on fig.

LEVER (R. J. A. W.). **Division of Entomology. Annual Report for 1941.**—*Agric. J. Fiji* **13** no. 1 pp. 23–24. Suva, 1942.

Some of the information in this report on insect pests in Fiji has already been noticed [*R.A.E.*, A **30** 315, 497]. Those recorded during 1941 included *Agonoxena argaula*, Meyr., on coconut, *Prodenia litura*, F., on *Colocasia*, *Heliothis armigera*, Hb., on maize, *Cirphis unipuncta*, Haw., on rice and sugar-cane, *Achaea janata*, L., and *Adoretus versutus*, Har., on rose leaves, *Polydesma umbricola*, Boisd., on leaves of *Pithecolobium* (*Enterolobium*) *saman*, *Argina cribraria*, Cl. (*astrea*, Dru.) on leaves and pods of *Crotalaria saltiana*, *Crocidolomia binotalis*, Zell., on cabbage, *Stictoptera bisexualis*, Hmps., on leaves of *Calophyllum inophyllum*, *Xyleborus rameus*, Schedl, in seeds of *Podocarpus vitiensis*, *Dinoderus minutus*, F., in bamboo stems, and *Sogata furcifera*, Horv., on rice. *Kalotermes repandus*, Hill, was found in timber in a house and in growing trunks of mangrove, *Bruguiera gymnorrhiza*, and *Catorama herbarium*, Gorh., in books, *Lasioderma serricorne*, L., in cheroots and *Necrobia rufipes*, DeG., in copra sacks. *Levuana iridescens*, B.-B., was reported from Colo East, but was doing little damage to coconut; neither this species nor *Promecotheca reichei*, Baly, were present on coconut in Rabe, but the Phasmid, *Graeffea cocophaga*, Newp., was injurious. The *Citrus* moth, *Cryptoblabes plagioleuca*, Turn., was identified from Rarotonga.

Of a colony of *Microphanurus basalis*, Woll., introduced from New South Wales for the control of *Nezara viridula*, L., in March [*cf.* **30** 157] 11,000 individuals were liberated locally and 350 were sent to Tonga. The importation of crucifers from Australia has been prohibited owing to the recent discovery of *Pieris rapae*, L., there. Nearly 42,000 laboratory-reared adults of *Dirhinus* sp. were liberated against fruit-flies [*Dacus*] during the year [*cf.* **29** 496], and a colony of the lantana bug, *Teleonemia scrupulosa*, Stål, was sent to Lodoni and one of *Liothrips urichi*, Karny, was sent to Gau for the control of *Clidemia hirta*.

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LEVER (R. J. A. W.). **Entomological Notes.**—*Agric. J. Fiji* **13** no. 1 pp. 24–26, 9 refs. Suva, 1942.

Crossotarsus saundersi, Chapuis, which has been recorded from various trees in Fiji [*R.A.E.*, A **29** 170 ; **30** 315], was observed boring in the bark of a healthy rubber tree in September 1941. No penetration had occurred beyond the bark, as all the beetles had been killed by the latex, 25 being found in a six-inch square. No attack was observed on surrounding trees. *Pachymerus gonager*, F., which was known to infest pods of *Acacia farnesiana* and ripe seeds of *Bauhinia monandra*, was found in November 1941 in the dry zone, where the rainfall averages 70 ins., boring inside the seeds of *Tamarindus indica*, from which it has not hitherto been recorded in Fiji. *Nezara viridula*, L., var. *smaragdula*, F., was observed on beans in Rabe and Taveuni early in October 1941 ; colonies of *Microphanurus basalis*, Woll. [see preceding abstract] were liberated in both islands. This parasite has been recovered from egg clusters of the bug on tomato leaves in the Suva area.

NIXON (G. E. J.). **A remarkable new Genus of Telenominae (Hym., Proctotrupoidea, Scelionidae).**—*Ann. Mag. nat. Hist.* (11) **9** no. 54 pp. 462–464, 5 figs. London, 1942.

Descriptions are given of the adults of both sexes of *Nasdia prosper*, gen. et sp. n., bred from *Pseudococcus* sp. (presumably the eggs) in the Fiji Islands. The genus is tentatively referred to the TELENOMINAE, though it differs from any other genus of this subfamily in venation and number of antennal segments.

FITZGERALD (J. S.), RATCLIFFE (F. N.) & GAY (F. J.). **The Use of Mineral Oils and Tar Oils for Wheat Weevil Control.**—*J. Coun. sci. industr. Res. Aust.* **15** no. 1 pp. 59–71. Melbourne, 1942.

In view of the risk under present conditions in Australia of infestation by insects of grain stored in bags in sheds or on stacking sites, investigations were carried out to determine suitable materials and methods for treating such premises before fresh grain is introduced. Contact insecticides, especially those that also possess some fumigating effect, are the most suitable for this purpose, and since mineral oils and creosotes (unfractionated tar oils) are the cheapest and most readily available, attention was concentrated chiefly on them. Owing to the difficulty of carrying out field tests of value, the materials were assessed by means of quantitative laboratory tests on adults of *Calandra oryzae*, L., reared in the laboratory to ensure a uniform stock, and used the week after emergence, at which age they are more resistant than older weevils. Some tests were also made with *Tribolium castaneum*, Hbst. A dipping technique was first employed, but this did not reveal the fumigating effect of materials such as tar oils and was augmented and largely superseded by a spraying technique, which is described.

Emulsions with high contact but no chemical toxicity, such as those containing mineral oils, were effective as sprays only if the treated surface was so saturated that some liquid remained for a time unabsorbed. Under these conditions, high mortality may be given by emulsions with poor contact toxicity, but if the weevils can escape from the treated surface the mortality is reduced, even when due to chemically toxic emulsions. Indications were obtained in outdoor spraying tests that weevils temporarily immobilised by oil sprays quickly regain their normal activity and start to wander. The presence of a toxic vapour given off by tar-oil emulsions and operative over only a very short distance was demonstrated by the reduction in mortality when a current of air was passed over the weevils after treatment, and by the high mortality among untreated weevils placed on sprayed sand or on sprayed sand covered with a thin layer of dry sand, which almost equalled that among treated

weevils. J. S. Fitzgerald showed by experiments on weevils in closed containers that the toxicity of creosote vapour, especially that of low-boiling creosotes, is high. Dipping experiments showed that the degree of fineness of mineral-oil emulsions and the size of the droplets affect their toxicity more than the type of oil. Except when diluted with hard water, they were ineffective unless the diameters of the droplets ranged up to or over 60 microns ; emulsions prepared from mayonnaise stock were therefore of no value in dipping tests, although they gave high mortality when they were used on a relatively unabsorbent surface and the weevils were confined to the treated area. Droplet size is influenced by the quantity, as well as the hardness, of the water used to prepare the emulsion, and by the vigour of the agitation ; a coarse and a fine emulsion of the same oil gave about 100 and 0 per cent. mortality, respectively, in dipping tests.

Stability and droplet size are of less importance in tar-oil emulsions, though the fumigating effect of two emulsions varying in stability and fineness was found to differ. The difference is explained on the assumption that the finer and more stable emulsion did not break on contact with the sand on which the weevils were placed and that since the liquid was absorbed as an unbroken emulsion, most of the creosote was carried too far below the surface for effective fumigant action.

Mineral-oil emulsions would be of value as dunnage dips and for treating stacking sites and the floors of sheds if these are composed of concrete, wood or hard-packed soil, and under suitable conditions they gave satisfactory mortality at dilutions of 1 : 40 and over. They are not suitable for spraying absorbent surfaces such as sandy soil, and are unlikely to prove effective on vertical surfaces unless the weevils are washed off by the force of the application. A pressure of 30 lb. per sq. in. was used in the spraying tests, and it is possible that these emulsions would be effective on absorbent surfaces if the pressure were increased to 200–300 lb. A further disadvantage is the extent to which the nature of emulsions prepared from commercial miscible mineral oils emulsified with soap is influenced by the hardness of the water. An emulsion containing an added toxicant and prepared from a mayonnaise stock of fuel oil of low viscosity, which should not be affected by variations in the hardness of the water with which it is diluted, gave complete control at a dilution of 1 : 20 when applied as a spray at rates of 1 or 2 gals. per 50 sq. ft. to weevils on sand or when applied at 2 gals. per 50 sq. ft. to sand on which untreated weevils were later placed, and 99 per cent. when used at a dilution of 1 : 40 in a dip test.

The only tar distillates that are economically practicable for application on a large scale to sheds and stack sites are creosotes. Their high-boiling fractions were found to be the more toxic, but the low-boiling fractions contributed to their fumigating effect. The contact toxicity of creosote emulsions is erratic, and no emulsion prepared by commercial methods gave consistently high mortality when used at a dilution of 1 : 40 in dip tests. Their effectiveness increased with the concentration of the oil. Even with the most effective commercial sample, used at a dilution of 1 : 20, consistent kills of 90–100 per cent. of weevils sprayed on sand were obtained only when the rate of application was equivalent to 2 gals. per 50 sq. ft. Unlike mineral-oil emulsions, creosote emulsions would probably give good results on premises providing a wide variety of treatment conditions, but it is not known whether they would prove as effective and economical for this purpose as mineral-oil emulsions reinforced with toxic chemicals. They would probably not be effective at dilutions greater than 1 : 20, and the dilution (1 : 15) in use for sprays in Western Australia is recommended ; structures that are exposed to wind and abut on untreated ground would probably require higher concentrations. Even very slight breezes caused considerable reduction in mortality due to creosote emulsions. It is doubtful whether their fumigating effect at a dilution of 1 : 40 is enough to counteract their poor contact toxicity, and they are probably less effective as

dunnage dips than mineral-oil emulsions. In view of the variation in effectiveness of creosote emulsions and the fact that those giving the greatest mortalities as dips were also effective as sprays, an emulsion should be tested as a dip before use.

Mineral-oil emulsions employed as dips for used grain sacks became progressively less effective as the treatment proceeded, owing to the breaking of the coarse emulsion needed for high mortality on contact with the bags, and tar-oil emulsions are therefore recommended for this purpose. Certain moderately fine and stable mineral-oil emulsions gave high mortality when the treated bags were stacked wet for 48 hours before being dried. When bags treated with a suitable tar-oil emulsion (1 : 40) were stacked in this way, almost complete mortality was obtained. Crude naphtha (a low-boiling tar-oil fraction) gave consistently good results as a dip. The adverse effect on coarse emulsions of the fabric of the bags is less marked in creosote than in mineral-oil emulsions, and it is possible that one suitable for spraying could also be used for dipping.

If power-spraying equipment with a suitable nozzle is available, the use of undiluted oils on sheds and stacking sites might prove economical, since the cost of emulsification, the difficulty of preparing a suitable emulsion, and the need for adequate supplies of water are avoided, and the spray could be applied round bags of wheat where the water content of emulsions would make their use inadvisable. Nozzles producing fine mist-like sprays proved less satisfactory than those producing large droplets with a faster rate of application. Good results were given by a light distillate diesel fuel oil, a high-boiling creosote and one boiling at 200–240°C. [392–464°F.], but crude naphtha was ineffective and dark fuel oils of the type used in stationary diesel engines were less satisfactory than the light one. Mortality was increased to a marked extent when 1–2 per cent. dinitro-ortho-cyclohexylphenol was incorporated into the diesel oil, but atomised sprays containing it produce an irritant effect on the throat and nose of the operator.

Oriental Peach Moth Investigations. General Statement, July, 1941.—*J. Coun. sci. industr. Res. Aust.* **15** no. 1 pp. 77–80. Melbourne, 1942.

In this paper, the results of investigations in the Goulburn Valley, Victoria, on the possibility of controlling *Cydia molesta*, Busck, on peach by chemical and biological methods [*R.A.E.*, A **27** 639 ; **29** 141 ; **30** 101, etc.] are summarised, the progress made between 1937 and 1941 by *Macrocentrus ancylivorus*, Rohw., which was the only parasite liberated that showed any promise, is described, and the present situation with regard to the moth reviewed. The numbers of each of six introduced parasites that were liberated each season between 1935 and 1941 are shown in a table ; in addition to those already noticed [*cf.* **27** 544], they included *M. delicatus*, Cress., 133 of which were released in 1938–39.

No parasites were imported from the United States during 1940–41, since sufficient numbers had been liberated during the previous five years to ensure establishment if conditions were favourable. Populations of *C. molesta* were the lowest recorded, but 8,400 infested peach shoots were collected, from which 3,220 adults resulted. Only one individual of *M. ancylivorus* was obtained, however, and that developed in a first-generation larva. Weather conditions in the Valley during late autumn and winter appear to be unfavourable to it, and there is evidence that the parasites that develop in last-generation larvae give rise to adults in late autumn, when host larvae are not available. An attempt to develop a rearing technique that would enable parasites to be produced in numbers sufficient to permit effective liberations each spring was unsuccessful because no suitable substitute for fresh peach shoots on which to breed large numbers of *C. molesta* could be found. A small liberation, comprising 20 males and 20 females, of *M. ancylivorus* was made during the year.

Entomological Investigations.—*15th Rep. Coun. sci. industr. Res. Aust. 1940–41* pp. 17–27. Canberra [1942].

Much of this account of work on beneficial and injurious insects in Australia in 1940–41 deals with investigations in connection with insect pests of stored wheat, some of the results of which have already been noticed [*R.A.E.*, A **30** 217, 218, 278 ; **31** 42]. *Rhizopertha dominica*, F., proved to be more susceptible to fumigants than *Calandra oryzae*, L., or *C. granaria*, L., and was effectively controlled to a depth of 12 ins. in the surface layer of heating wheat stored in a silo by carbon bisulphide applied at the rate of 8 oz. per square yard with a sprinkler, or of 18 ins. if the surface was covered with a light tarpaulin. In laboratory experiments on the effectiveness of treating the grain with inert mineral dusts, the three insects differed to some extent in their reactions, the efficacy of the dusts decreased as the atmospheric humidity and the moisture content of the wheat increased, samples of the same mineral from different deposits in general gave similar results, and dusted insects lost moisture more rapidly than undusted ones. Of the Australian dusts, the most effective were magnesite, a limonite with a high iron content, calcined diatomaceous earth, ferruginous bauxite and dolomite. Magnesite gave outstanding control and, at a concentration of 0·5 per cent. or less, would probably be effective in all but the most unfavourable climates. It is possible that even the less satisfactory dusts, such as dolomite, might give satisfactory protection, since infestations built up more slowly in grain treated with them than in the controls. Milling tests indicated that these dusts are removed by the ordinary mill-cleaning process, but the appearance and the free-running properties of the grain are adversely affected. Experiments in which weevils and infected wheat were buried in trays of sand and the latter treated with various insecticides in an attempt to discover a suitable method of treating loose earth floors in sheds in which infested grain may become buried, indicated that crude naphthalene or emulsions of carbon bisulphide or orthodichlorobenzene might be effectively used.

In the course of work on the biological control of noxious weeds, *Chrysomela* (*Chrysolina*) *hyperici*, Forst., was found to have spread considerably in the district in Victoria in which it was shown to be established in 1939 [**30** 101] and to have destroyed St. John's wort (*Hypericum perforatum*) in some places. Colonies liberated at four other places in Victoria and two in New South Wales in 1939 and in one place in Victoria in 1940 have become established. Two further liberations were made in 1940 in New South Wales. *Agrilus hyperici*, Crtz., was recovered from each of the three places in eastern Victoria at which it was liberated during the previous year ; the first adults emerged in the field in November and December 1940. Liberations were made in Victoria and New South Wales in 1940 from material imported from France ; to ensure future supplies, males and females were isolated in pairs on sleeved plants in an experimental plot in Victoria and transferred to others when eggs had been deposited. The Chrysomelid previously recorded as *Chrysomela* (*Chrysolina*) *geminata*, Payk. [**29** 143], but here stated to be *C.* (*C.*) *gemellata*, Geoffr., has not become established in Victoria ; further stocks are being reared for liberation in a part of New South Wales that is thought to be more suited to it. Colonies of *Teleonemia scrupulosa*, Stål, released in forest areas in northern New South Wales against *Lantana camara* appear to be becoming established. A consignment sent to India by air arrived in a satisfactory condition. Small numbers of the Trypetid, *Euaresta aequalis*, Lw., were found breeding on Noogoora burr (*Xanthium pungens*) in places in southern Queensland where it had been liberated*, but it is not considered likely to exert any appreciable control,

* This and other insects were recorded on *X. spinosum* in the previous report [**30** 101], but it would appear that all these records actually refer to *X. pungens*, particularly as the name Noogoora burr was used in connection with them.—*Ed.*

since its life-history may not become adapted to the fruiting of *X. pungens*, which occurs erratically throughout the region. Studies in Hawaii indicated that the effect of insects on the spread of nutgrass (*Cyperus rotundus*) is negligible, but this may be due to heavy parasitism of *Athesapeuta cyperi*, Mshl., and *Bactra truculenta*, Meyr. Of ten insects found to be associated with Mexican poppy (*Argemone mexicana*) in Texas, the only two of possible importance in its control are *Conotrachelus leucophaeatus*, Fhs., which causes considerable injury to the roots and also breeds on *Amarantus*, and *Languria laeta*, Lec., which, though abundant, did little damage. The only insect of importance on mint weed (*Salvia reflexa*) in Texas was *Mordellistena* sp., which destroys the inflorescences.

Study of the outbreak of *Chortoicetes terminifera*, Wlk., in 1939–40 confirmed previous conclusions regarding the effect of weather conditions [**30** 102, 420]. The outbreak in 1940–41 was confined to the north-eastern part of the infested area of New South Wales and continued only from October till November, since drought caused high mortality among the hoppers; for the first time since 1932, neither swarms nor egg-beds were present between December and June. Scattered hoppers hatched after rains in December 1940, mainly in the outbreak areas, but heavy mortality resulted from floods in January, particularly in Queensland and north-eastern New South Wales, although in some places survival was sufficient to give rise to adult populations of one per four yards. Few of the resulting eggs had hatched at the time of writing. Studies on cultures of *C. terminifera* reared from hatching to death in the laboratory at temperatures of 80, 90 and 100°F. and relative humidities of 10–100 per cent., in which, however, it was not possible to distinguish the effect of atmospheric humidity from that of the water content of the food, showed that the length of the hopper stage, the number of instars and the length of each are least at high temperatures and humidities and greatest at low ones. The males normally pass through fewer instars than the females. Mortality was high at the extremes of humidity, but did not appear to be much influenced by temperature at favourable humidities. Adults and hoppers were darker in colour at low than at high temperatures; green individuals did not appear. Locusts reared in groups of three in a small cage were much darker than those reared singly, indicating development towards phase *gregaria*. It has been found that practically all the outbreak areas are situated in zones in which the normal season has no month too wet and not more than three successive months too dry for breeding and in which two or more generations can develop each year without excessive mortality. Within these climatic zones they occur only where oviposition sites, characterised by a high proportion of bare compact soil, preferably in large patches separated from each other by vegetation up to 6 ins. in height, are near concentration zones capable of providing food and shelter for the active stages during dry periods, which are generally situated in slight depressions in heavy soil and support patches of vegetation 1–3 ft. high separated by bare soil or low vegetation, The most favourable breeding conditions occur when oviposition sites and concentration zones coincide or are adjacent; roads and tracks are important in producing this type of environment. With the exception of the ibis, which exerts considerable control of the non-swarming population, predators and parasites are unimportant. The optimum temperature, recorded by the black-bulb thermometer, for adults and late nymphs was 40–44°C. [104–111·2°F.]. Egg-pods contained an average of 52 eggs, and 40–100 of the eggs laid per female hatched. The rate of sexual maturation was related to the amount of green food available and extended over 2–12 weeks. Eggs did not develop in soil containing less than about 4 per cent. moisture, which is approximately a third of the wilting coefficient for the same soil.

As a result of infestation by *Halotydeus destructor*, Tucker, of subterranean clover [*Trifolium subterraneum*] in experimental plots in Western Australia during two seasons, there was a marked reduction in the yield of foliage and

seed, that of the former being reduced by 50 and 66·6 per cent. by natural and artificial infestation, respectively [*cf.* **30** 102] ; injury was accentuated by dry conditions. The effect of the mite on other pasture plants is slight. Treatments for control were tested on small pasture plots isolated by means of creosote to restrict the movement of the mites ; population counts before and after application were made on a number of areas marked off on each plot by metal enclosures. Excellent results were obtained with a dust containing dinitro-ortho-cyclohexylphenol (DN-Dust) and a bait of chaff moistened with a solution of cane sugar and sodium fluoride ; good control was also given by a mixture of tobacco dust, slaked lime and kerosene. There are five instars during the development period. The fertility of the adults was shown to be considerably increased when they fed on the flowers of cape weed (*Cryptostemma calendulaceum*), which was previously suspected of increasing the severity of attack [*cf.* **29** 141, etc.].

Evans (J. W.). **The Gorse Weevil.**—*Tasm. J. Agric.* **13** no. 1 pp. 15–18, 2 figs., 5 refs. Hobart, 1942.

The author gives a brief account of the life-history in England of *Apion ulicis*, Forst. [*cf. R.A.E.*, A **16** 540], which was introduced into New Zealand for the control of gorse (*Ulex europaeus*) in 1937 and has become established there [*cf.* **28** 566 ; **30** 278]. Consignments of the weevil from New Zealand were liberated in two localities near Hobart, Tasmania, in July and October 1939, and inspections in July and November 1941 showed that it was well established. By distributing it to all gorse areas in the State as soon as sufficient quantities are available, it is hoped to limit the spread of the weed, though it will be impossible to eradicate it. It is pointed out, however, that gorse is of some value as food for sheep and for enriching the soil.

Swan (D. C.) & Stephen (V. A.). **An Injector for liquid Fumigants.**—*J. Aust. Inst. agric. Sci.* **8** no. 1 p. 26, 1 fig. Sydney, 1942.

The instrument described is designed for the introduction of small measured doses of carbon bisulphide into bagged wheat for the control of grain weevils. It is based on a standard sheep-drenching gun in which the nozzle is replaced by a stainless steel tube of $\frac{1}{8}$ in. bore and $6\frac{1}{2}$ ins. long, with a detachable point that can be pushed readily into bagged wheat under stack pressure. As carbon bisulphide attacks rubber and penetrates through ordinary types of flexible spiral metal tubing, a metal reservoir for it is attached to the gun itself, a spring valve being fitted to the metal inlet cap.

Schindler (A. J.). **Insect Transmission of Wallaby Ear Disease of Maize.**—*J. Aust. Inst. agric. Sci.* **8** no. 1 pp. 35–37, 1 fig. Sydney, 1942.

Late-planted maize in south-eastern Queensland is affected and young crops sometimes destroyed by a disease known as wallaby ear, which is thought to be due to a virus and is not known to occur elsewhere. The symptoms are generally first observed towards the end of January ; small swellings appear on the secondary veins on the lower surface of the leaves at the top of the plant, the veins rapidly become swollen, the plant is dwarfed and becomes dark in colour, the pollen yield is reduced, and the growth of the silks, cobs and grains retarded. As the disease occurs at a season that may be very wet or very dry, it was first thought to be due to one or other of these conditions, but in 1940, the Jassid, *Macrosteles* (*Cicadula*) *bimaculatus*, Evans, was observed to be multiplying rapidly in the field when the symptoms were appearing and to be numerous when the disease was most prevalent. There was no evidence of the presence of a pathogenic fungus, and the manner in which the disease spread suggested that it was transmitted by insects. Previous experiments showed that the disease

could be transmitted only with difficulty, if at all, by mechanical means, and that no X-bodies were present. In experiments in 1941, symptoms developed after about three weeks in plants in insect-proof cages into which adults and nymphs of *M. bimaculatus* taken from diseased plants, or of *M. bimaculatus* and a prevalent Delphacid, *Peregrinus maidis*, Ashm., were introduced. None appeared on plants exposed to *P. maidis* alone for 18 days and then to both species, or in control plants. It is concluded that the disease is transmitted by Homoptera that are prevalent after mid-summer, and that *M. bimaculatus* is mainly responsible. Hybrid varieties of maize exhibit varying degrees of resistance, which can be related to some of the parent inbred lines.

BEIRNE (B. P.). **Observations on the Life-history of *Praon volucre* Haliday (Hym.: Braconidae), a Parasite of the Mealy Plum Aphis (*Hyalopterus arundinis* Fab.).**—*Proc. R. ent. Soc. Lond.* (A) **17** pt. 4–6 pp. 42–47, 19 figs., 5 refs. London, 1942.

Hyalopterus arundinis, F., which is an important pest of plum, is parasitised in Ireland by *Praon volucre*, Hal. Adults of this Braconid, all stages of which are described, were observed in flight and resting on the foliage of plum during the day. Oviposition appeared to take place most frequently during the morning; the egg is generally deposited between the segments of the abdomen of the host, though it may be laid in any part of the body. Only one egg is laid at a time, but two or more may be laid in the same host by the same or different females, and as many as five first-instar larvae and three eggs were found in a single Aphid. Only one parasite, however, is able to complete its development. The females will also attempt to oviposit on any object on the foliage that resembles the Aphid in size or shape. The larva hatches in 3–5 days and passes through five instars, causing the death of the host in the fourth. When fully grown, it emerges from its host and spins a cocoon on the leaf. It pupates after about a week, and the adult emerges 7–10 days later, complete development having lasted less than a month. Newly-emerged adults were frequently observed feeding on the waxy exudation produced by the Aphids.

Adults emerged from 77 per cent. of 291 cocoons collected on plum at the end of July and the beginning of August, and of these 53 per cent. were females. A Chalcidoid and a Cynipid hyperparasite, both undetermined, emerged from 10 and 7 per cent. of the cocoons, respectively. The larvae of both feed externally on the larvae or pupae of *P. volucre* in the cocoons, and the eggs are probably deposited on fully-grown larvae that have left their hosts but have not completed the spinning of their cocoons. No other Aphidiine parasites were bred from *H. arundinis*, and *P. volucre*, which is the most important Hymenopterous parasite of the Aphid in Ireland, is probably of less importance in its control than Syrphid larvae. The percentage of parasitism varied considerably in different parts of the tree, but was generally less than 5 among large concentrations of Aphids, though it was as high as 50 among isolated Aphids towards the end of the season. *P. volucre* was also observed parasitising *Anuraphis padi*, L., on plum and has been recorded from Aphids attacking other plants.

MCMAHON (E.). **Observations on Flea Beetles which attack cruciferous Crops.**—*J. Dep. Agric. Eire* **39** no. 1 pp. 80–83, 8 refs. Dublin, 1942.

Since flea-beetles cause serious damage to cruciferous crops in Ireland, samples were obtained from various parts of the country during the spring and summer of 1941 to determine which were the most injurious species. The commonest has hitherto been considered to be *Phyllotreta nemorum*, L., but it was found in the course of this study that *P. undulata*, Kutsch., was the most abundant. *P. atra*, F., was the next in importance, and it was the major pest in some districts, occurring on crops in open fields and gardens and sometimes causing

more severe damage than *P. undulata*. *P. nigripes*, F., emerged earlier in spring than the first two, and *P. nemorum*, *P. sinuata*, Steph., and *Psylliodes cuprea*, Koch, were of minor importance. The most serious injury is caused to seedlings. In tests in which *P. undulata*, *P. atra* and *P. nigripes* were caged on swede seedlings, the first two caused severe damage to the cotyledons and also cut the hypocotyls, the latter type of injury being more serious in the case of *P. atra*. *P. nigripes* caused similar damage, but the total injury was relatively slight. Seedlings of cabbage, garden turnip, kale, swede, radish and mustard, grown in close proximity, were all attacked by flea-beetles; garden turnip, swede and radish were severely injured, cabbage and kale were only slightly injured, and mustard was relatively unattractive in the cotyledon stage. When the rough leaves were formed, however, injury to swede, cabbage and kale was insignificant, whereas mustard, garden turnip and radish were severely attacked. Of the last three, mustard was the least injured, owing to its rapid growth, and radish the most. *P. atra* was much more numerous than *P. undulata* during this test, and *P. nigripes* was fairly common until mid-May, after which its numbers decreased rapidly.

BERAN (F.). **Die Bekämpfung der San José-Schildlaus (*Aspidiotus perniciosus* Comst.) mit Spritzmitteln.** [The Control of the San José Scale with Sprays.] —*Z. PflKrankh.* **52** pt. 6 pp. 289–316, 6 figs., 32 refs. Stuttgart, 1942.

The following is based on the author's summary of this detailed account of experiments in 1940–41 in Austria on sprays for the control of *Aspidiotus perniciosus*, Comst., on currant and various fruit trees. In comparative tests of commercial and home-made winter oil sprays, mineral-oil emulsions were the most effective, and gave complete mortality at a concentration of 4 per cent. (equal to 3·2 per cent. actual oil). The tar distillates known as heavy oil and medium oil fruit-tree carbolineums [*R.A.E.*, A **29** 231] were also satisfactory, but lime-sulphur and emulsified fruit-tree carbolineums [*loc. cit.*] were not. A commercial preparation containing 50 per cent. dinitro-ortho-cresol gave complete mortality at strengths of not less than 2 per cent., but would be too expensive at this concentration for large-scale use.

In further tests, 4 mineral oils (spindle oils) were emulsified with and without soap and applied to the trees; the emulsions prepared with soap were considerably more effective than those emulsified mechanically, and in both series the oil with the highest viscosity, highest boiling point, lowest unsulphonated residue and lowest volatility was the most effective.

Excellent results were obtained with combinations of emulsified fruit-tree carbolineums and alkalis, and the cheapest of those that gave complete mortality contained 8 per cent. emulsified fruit-tree carbolineum and 2 per cent. sodium hydroxide. The buds of various fruit trees were not at all or only very slightly injured by sprays of this type. Good results were also given by the substitution of organic substances for the sodium hydroxide, but the cost was higher.

For studying the mode of action of the insecticides, individual female scales were enclosed on the tree trunks in rings of a transparent moulded material, attached by a special adhesive and fitted with screw-on lids. It was found that the scales were not killed immediately by any of the insecticides and that in one case death was delayed for as long as 6 weeks.

VAN SLOGTEREN (E.) & DE BRUYN OUBOTER (M. P.). **Investigations on Virus Diseases of Narcissus.**—[*Publ.*] *Inst. Phytopath. Lab. Bloembollen-Onderzoek Lisse* no. 64, 18 pp. Wageningen, 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 6 pp. 325–326. Stuttgart, 1942.)

A description is given of the symptoms of a virus disease of narcissus in Holland that usually causes a yellow streak of the leaves and is transmissible

artificially by various methods. The Aphids, *Macrosiphum* (*Aulacorthum*) *solani*, Kalt., *Aphis* (*Doralis*) *fabae*, Scop., and *M. solanifolii*, Ashm. (*euphorbiae*, auct.) appear to be the chief vectors in the field ; no transmission was obtained with *Myzus persicae*, Sulz. The plants should be kept under close observation and those thought to be infected removed immediately.

Benassi (L.). **La lotta contro la processionaria del pino.** [Measures against the Pine Processionary Caterpillar.]—*Ric. For. Ital.* **2** pp. 21–26. 1940. (Abstr. in *Z. PflKrankh.* **52** pt. 6 p. 333. Stuttgart, 1942.)

Thaumetopoea pityocampa, Schiff., is very harmful in the forests of Varese, North Italy. From 1928 to 1935, 1·5 million larval nests were destroyed. Control is difficult, and the author recommends a study of possible parasites and of the predator, *Calosoma sycophanta*, L.

Deubner (W.). **Der grosse Fichten-Borkenkäfer** *Ips typographus* **und die Möglichkeit seiner Bekämpfung.** [*I. typographus* and the Possibility of combating it.]—*Dtsch. Forstztg* **9** pp. 90–91. 1940. (Abstr. in *Z. PflKrankh.* **52** pt. 6 p. 333. Stuttgart, 1942.)

The spread of *Ips typographus*, L., is favoured if the trunks of spruce trees are barked immediately after felling. A large number of beetles leave the trunk when it is felled, but they return to it within 24 hours unless the bark has been removed, in which case they seek other, previously uninfested, spruce trees. For this reason, the bark should not be taken off until 2–3 days after felling.

Hagenguth (K.). **Biochemische Versuche zur Kartoffelkäferfestigkeit verschiedener Kartoffelarten und ihrer Bastarde.** [Biochemical Experiments on the Resistance to the Potato Beetle of various Varieties of Potato and of their Hybrids.]—*Mitt. biol. Reichsanst.* no. 63 p. 65. Berlin, 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 6 p. 335. Stuttgart, 1942.)

Experiments in Germany showed that there is no notable difference in the solanin content of the leaves between varieties of potato that are heavily attacked by *Leptinotarsa decemlineata*, Say, and those that are not.

Kaufmann [O.]. **Untersuchungen über den Kleeblattkäfer** (*Phytonomus punctatus*). [Investigations on the Clover Leaf Weevil, *Hypera punctata*.]—*Mitt. biol. Reichsanst.* no. 63 p. 83. Berlin, 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 6 p. 336. Stuttgart, 1942.)

Two strains of *Hypera* (*Phytonomus*) *punctata*, F., occur together on clover in Germany. The adults of one emerge in July–August, hibernate while still immature and oviposit from the end of March onwards, chiefly in April–May. The adults of the second emerge in spring ; oviposition begins in September and is continued into the winter, depending on the weather, but is not resumed in spring. The maximum number of eggs observed per female was 2,260. The eggs are parasitised by *Anaphoidea luna*, Gir., and the larvae by *Bathyplectes corvinus*, Thoms., and *Pezomachus transfuga*, Först., which is probably a hyperparasite attacking *B. corvinus*.

Langenbuch [R.]. **Salatsamenwickler und Lattichfliege.** [*Eucosma conterminana* and *Hylemyia gnava*.]—*Mitt. biol. Reichsanst.* no. 63 p. 78. Berlin, 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 6 p. 337. Stuttgart, 1942.)

The larvae of *Eucosma* (*Semasia*) *conterminana*, H.-S., and *Hylemyia* (*Chortophila*) *gnava*, Mg., occur as competitors on lettuce in Germany [*cf. R.A.E.*,

A **16** 592], and the control of the Tortricid alone results in an increase of injury by the Anthomyiid. Contact dust insecticides effective against both should therefore be applied.

Zillig (H.) & Henrici (H.). **Biologie und Bekämpfung der Traubenwickler** (*Clysia ambiguella* **und** *Polychrosis botrana*). [Biology and Control of the Vine Moths, *Clysiana ambiguella* and *P. botrana*.]—*Mitt. biol. Reichsanst.* no. 63 pp. 82–83. Berlin, 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 6 p. 338. Stuttgart, 1942.)

Experiments carried out in Germany in 1939 indicated that the use of large numbers of glass bait-traps is of little value for the control of the vine moths, *Clysiana* (*Clysia*) *ambiguella*, Hb., and *Polychrosis botrana*, Schiff. The bait was more attractive to the females than to the males, but only about 10 per cent. of the moth population was taken during the main flight period, and the captured females had already laid considerable number of eggs.

Kaltwasser (J.). **Wachstumsgeschwindigkeit und Giftresistenz der Larven des Hausbockkäfers** *Hylotrupes bajulus*. [Rate of Growth and Resistance to Poison of the Larvae of *H. bajulus*.]—*Mitt. biol. Reichsanst.* no. 63 pp. 86–87. Berlin, 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 6 p. 339. Stuttgart, 1942.)

Investigations in Germany showed that the growth of newly hatched larvae of *Hylotrupes bajulus*, L., was most rapid in the outermost portion of a spruce trunk felled one year before. In other timbers it was quicker in the outermost portion than in the inner sapwood. It was much slower in float-wood than in timber stored dry. The resistance of the larvae to insecticides was tested by impregnating timber with various poisons, but the quantities requisite to ensure mortality are no guide to the value of the substance as an insecticide, because the larvae are not harmed by boring short distances through heavily impregnated wood.

Frey (W.). *Phytomyza rufipes* **Mg. an Raps.** [*P. rufipes* on Rape.]—*Mitt. biol. Reichsanst.* no. 63 pp. 83–84. Berlin, 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 6 p. 339. Stuttgart, 1942.)

Larvae of *Phytomyza rufipes*, Mg., were found in the leaf-stalks of winter rape from 35 out of 78 localities in Schleswig-Holstein, but caused negligible damage. The eggs are laid on the edges of the leaves near the ribs, from which the larvae mine into the leaf-stalks. Pupation occurs in the upper layer of the soil.

Maercks (H.). **Untersuchungen über Wiesenschnaken.** [Investigations on Tipulids.]—*Mitt. biol. Reichsanst.* no. 63 pp. 96–97. Berlin, 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 6 p. 339. Stuttgart, 1942.)

Factors favouring the increase of Tipulids in north-western Germany are briefly reviewed [*cf. R.A.E.*, A **31** 36]. In 1939, the chief flight period of *Tipula paludosa*, Mg., occurred in the second half of August, when there was heavy rain, and the larvae fed on the leaves of rye and clovers. There was a strong flight of *Nephrotoma* (*Pales*) *maculata*, Mg., at the end of May on clover fields in the coastal regions, and adults of *Tipula vernalis*, Mg., occurred at about the same time in moorland regions. The eggs of the last two are very resistant to drought while they are dormant, but require a high degree of moisture in late summer for hatching. A poison bran bait [*cf.* **27** 520] in competition with lettuce, white clover or rye is likely to give good results only against young Tipulid larvae.

Speyer (W.). **Zur Bekämpfung des Gartenlaubkäfers** (*Phyllopertha horticola* **L.).** [Control of *Anomala horticola*, L.]—*NachrBl. dtsch. PflSchDienst* **21** pp. 72–73. 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 6 pp. 341–342. Stuttgart, 1942.)

Adults of the Rutelid, *Anomala* (*Phyllopertha*) *horticola*, L., seriously injure the leaves and young fruits in orchards in the Lower Elbe district. In laboratory tests, pyrethrum did not give satisfactory control, but derris sprays were fully effective.

Tempel (W.). **Beiträge zur Kenntnis der Lebensweise und der Bekämpfung des Heuspanners** (*Acidalia herbariata* **F.).** [Contributions to the Knowledge of the Habits and Control of *Sterrha inquinata*, Scop.]—*Arb. physiol. angew. Ent. Berl.* **8** pp. 128–138. 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 6 p. 342. Stuttgart, 1942.)

The author records the results of feeding experiments in which 70 different dried herbs were offered to the larvae of *Sterrha inquinata*, Scop. (*Acidalia herbariata*, F.) and points out that an investigation of the pharmacological plants that are not attacked by this Geometrid might result in the discovery of new insecticides. Herbs that are not too heavily infested can be freed from the larvae, which are negatively phototropic, by subjecting them to a powerful light.

Bosma (B.). **De bestrijding van spint en bladluis.** [The Control of Red Spiders and Aphids.]—*Meded. Tuinbouwvoorlichtingsdienst* no. 23, 47 pp. The Hague, 1940. (Abstr. in *Z. PflKrankh.* **52** pt. 6 p. 343. Stuttgart, 1942.)

The author gives a brief account of the biology of *Paratetranychus pilosus*, C. & F. (*Metatetranychus ulmi*, auct.) and Aphids on fruit trees in Holland, and discusses the results of control experiments carried out over several years. A spray of tar distillate (fruit-tree carbolineum) is very effective against the eggs of Aphids, but is unsatisfactory against the mite, which is much better controlled by mineral oils. In attempts to find a treatment effective against the eggs of both pests, mixtures of mineral oils and fruit-tree carbolineums proved unsatisfactory, but mineral oils mixed with dinitro-cresols or thiocyanates gave good results. Lime-sulphur is recommended as a substitute for mineral oils against *P. pilosus*, and its repeated application during the summer against scab gives prolonged protection.

Speyer (W.). **Weitere Beiträge zur Biologie und Bekämpfung des Kleinen Frostspanners** (*Cheimatobia brumata* **L.). IX. Mittlg.** [Further Contributions to the Biology and Control of the Lesser Winter Moth, *Operophtera brumata*, L. Ninth Communication.]—*Arb. physiol. angew. Ent. Berl.* **8** pp. 245–261. 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 6 pp. 343–344. Stuttgart, 1942.)

The occurrence in Germany of local races of *Operophtera* (*Cheimatobia*) *brumata*, L. [*R.A.E.*, A **26** 420] has been confirmed by crossing experiments. Some tar distillates (fruit-tree carbolineums) were more effective against this Geometrid than sprays containing dinitro-cresol; their effectiveness varied directly with the amount of heavy oil they contained. Deep digging beneath the fruit trees destroys the pupae in the soil, but is seldom practicable.

Rozsypal (J.). **Příspěvek k poznání škůdce máku nosatce** *Stenocarus fuliginosus* **Mrsh.** [A Contribution to the Knowledge of the Poppy Root Weevil, *S. fuliginosus*.] —*Ent. Listy* [*Folia ent.*] **4** pp. 34–60. 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 6 pp. 344–345. Stuttgart, 1942.)

The most serious pests of poppy in Moravia are the weevils, *Ceuthorrhynchus macula-alba*, Hbst., and *Stenocarus fuliginosus*, Marsh. The larva, pupa and

adults of the latter are described. The adults hibernate sometimes in the pupal case and sometimes free in the ground. In spring they migrate to poppy and feed on the underside of the leaves for about four weeks ; this attack may kill young plants. Females oviposit in the leaves, mainly from May to July, laying up to 21 daily, and an observed maximum total of 713. The larvae feed chiefly from mid-May to mid-July, first mining the leaves, and then making grooves and tunnels in the main root. The root blackens, the leaves yellow, and a severe attack kills the plant. The larvae pupate from the end of May in earthen cells at a depth of 1½–3 ins. Total development lasts about 6–7 weeks, and the loss caused may amount to 50 per cent. or more of the normal crop. Natural enemies include birds, the fungi, *Beauveria bassiana*, *Metarrhizium anisopliae*, and, rarely, *Sorosporella uvella*, and two Ichneumonids of the genera *Thersilochus* and *Phygadeuon*. Control is difficult, and an arsenical dust applied to the underside of the leaves was more effective than the sprays tested. Cultural measures, such as a suitable rotation of crops, soil cultivation, early sowing, thinning so as to leave the plants in large patches, and the use of fertilisers shortly before or during thinning, are of greater value.

Eichler (W.). **Brotkäfer als Holzschädlinge.** [*Sitodrepa panicea* as a Pest of Wood.]—*S. B. Ges. naturf. Fr. Berl.* 1939 pp. 41–43, 3 figs., 3 refs. Berlin, 1939. [Recd. 1943.]

Sitodrepa panicea, L., is a serious household pest in Germany, and a case is here recorded of damage done by it to a breadboard. This Anobiid was also recently observed attacking wooden partitions covered with wall paper ; it apparently developed in the paste.

Pickles (A.). **A Discussion of Researches on the Sugar-cane Froghopper (Homop., Cercopidae).**—*Trop. Agriculture* **19** no. 6 pp. 116–123, 44 refs. Trinidad, 1942.

A brief description is given of the damage caused to sugar-cane in Trinidad by *Tomaspis saccharina*, Dist., which was very injurious in 1939–41 [*cf. R.A.E.*, A **29** 52 ; **30** 495], and the attempts that have been made to control this Cercopid since it was first recorded as an important pest in the Island in 1889 are summarised. Suitable cultivation, drainage and liming of the soil, though they do not prevent infestation, enable the plants to resist mild attacks [*cf.* **25** 253 ; **27** 384], but direct measures are necessary when infestation is heavy. Cyanogas calcium cyanide dust against the nymphs usually gives good results when the outbreak is only moderately severe and the area affected is restricted, provided that the fields are clean and the treatment is properly carried out [*cf.* **15** 49, 50 ; **17** 531], and pyrethrum dust, which can be applied to large areas in a short time, gives high mortality of adults [*cf.* **29** 52 ; **30** 495]. It is considered that attempts to establish biological control should not be renewed unless there is definite evidence of the existence of promising parasites or predators [*cf.* **26** 370, etc.], but that investigation of resistant varieties [*cf.* **28** 225] and of insecticidal treatments, particularly with pyrethrum, should be continued. If the recent series of outbreaks continues, both calcium cyanide against the nymphs and pyrethrum against the adults should be employed wherever possible.

App (B. A.). **A Report of some Investigations on the Corn Insects of Puerto Rico.**—*J. Agric. Univ. Puerto Rico* **25** no. 4 pp. 21–31. Rio Piedras, P.R., 1942.

Investigations carried out in 1935–36 indicated that the chief pests of maize in Porto Rico are *Peregrinus maidis*, Ashm., which is a vector of yellow stripe [*Marmor zeae* of Holmes], *Euxesta stigmatias*, Lw. [*cf. R.A.E.*, A **27** 328],

Laphygma frugiperda, S. & A., and *Heliothis armigera*, Hb. ; *Aphis maidis*, Fitch, and *Diatraea saccharalis*, F., occurred in varying numbers, but caused little damage.

The eggs of *L. frugiperda* are laid on the leaves of young maize, and the larvae feed on the leaves and later move into the whorl. They sometimes destroy the entire whorl and kill the plants. Eggs are also laid on older plants, and the larvae then feed in the young ears, often entering from the side and between the leaf sheath and the ear. Duration of development from egg to adult averaged 35·6 days in the laboratory. Larvae were observed developing on grass (*Panicum*), and severe damage was caused by partly grown larvae feeding like cutworms on young maize in a field that had previously been in grass. These larvae were controlled by the application of a standard bait of bran and Paris green. In dusting experiments against larvae on the plants, lead arsenate with talc (1 : 9) gave the best control and caused no serious damage to the maize ; barium fluosilicate in talc (1 : 9) was less effective and more injurious to the plants, and derris or magnesium arsenate in talc and pure dusting sulphur were useless. Treatment was begun when the plants were about 15 days old, and continued until they began to tassel ; control was improved when the intervals between treatments were reduced from 10 days to a week.

A dust of barium fluosilicate and talc (1 : 1) applied 4–7 times, when the silks were present, gave significant control of *H. armigera* on sweet maize, but scorched the plants severely ; derris and talc (1 : 3) was effective in some cases, and magnesium or lead arsenate and talc gave poor control. None of the dusts was sufficiently effective for practical use. Control methods designed to prevent the young larvae from working down through the silks to the developing grain included fastening a metal ring, wire or string round the tip of the ear, covering the silks and ear tip with a cap of wrapping paper, cutting off the silks and squeezing the tip of the ear by hand. All the treatments gave significant control and merit further investigation, though cutting the silks after pollination rendered the ears liable to infestation by *E. stigmatias*.

Roque (A.) & Adsuar (J.). **Studies on the Mosaic of Peppers** (*Capsicum frutescens*) **in Puerto Rico.**—*J. Agric. Univ. Puerto Rico* **25** no. 4 pp. 40–50, 4 figs., 7 refs. Rio Piedras, P.R., 1942.

The authors describe the symptoms of a serious mosaic disease of peppers (*Capsicum frutescens*) that appeared in epidemic form in Porto Rico about 1938 and is now widespread there. It causes mottling of the foliage, stunting of the plants and malformation of the fruit. Experiments in which healthy pepper plants grown in the absence of insects were submitted to attack by Aphids that had fed on plants inoculated with the virus showed that *Myzus persicae*, Sulz., was a vector ; the virus was also readily transmitted mechanically. Its properties and relation to other viruses are discussed, and lists are given of plants, including tobacco, that developed symptoms when inoculated and of others that appeared to be immune ; of 84 varieties of peppers studied, only 2 were found to be resistant to the disease.

University of Puerto Rico Agricultural Experiment Station. Annual Report for the Fiscal Year 1940-1941.—viii+71 pp., 9 figs. Rio Piedras, P.R. [1942.]

Attempts to control *Myrmelachista ramulorum*, Wheeler, in coffee groves were continued in Porto Rico in 1940–41 [*cf. R.A.E.*, A **30** 293]. Applications of fresh meat at the top of collapsible metal tubes containing Cyanogas calcium cyanide flakes or potassium cyanide for two or three days at intervals of 3–4 weeks killed many of these ants, but had no apparent effect on the population ; daily applications for a month or more should show whether this method has any value.

It was found impossible to cross Arabian coffee with *Coffea stenophylla*, which is immune from the leaf-miner, *Leucoptera coffeella*, Guér. [*cf. loc. cit.*]. Parasitism of the larvae by the introduced Braconid, *Mirax insularis*, Mues., reached 2·9 per cent. in September in one locality, but had dropped to 1·6 per cent. by December and 0·5 per cent. in May. *Larra americana*, Sauss., which was introduced for the control of the changa [*Scapteriscus vicinus*, Scud.], is established at three points [*cf.* **30** 423].

Most sugar-cane fields in Porto Rico have either few egg-clusters of *Diatraea saccharalis*, F., or many egg-clusters with high natural parasitism by *Trichogramma minutum*, Ril., and in these, the release of artificially reared parasites is of little value. There are, however, in late autumn, winter and early spring, a few fields in which unparasitised fresh egg-clusters are abundant, and liberation of *Trichogramma* in these results in almost complete parasitism if the numbers of fresh clusters are maintained for a few days or weeks after release. The presence of such fields cannot be predicted from locality, season, temperature, rainfall or any other known factor.

Gnorimoschema gudmannella, Wlsm., which has recently been found in Porto Rico, destroys up to 80 per cent. of the flowers of peppers [*Capsicum annuum*] in old plantings. No injury to fruit was found where peppers were grown for shipment, and the maximum injury to flowers had reached only 9 per cent. by April 1941, when shipments to northern markets ceased, but fruits in old plantings grown for the local market were attacked. The flowers of hot pepper [*C. frutescens*] were also attacked. An undescribed Encyrtid of the genus *Copidosoma* parasitised 40 per cent. of the larvae ; minor parasites were identified as undescribed species of *Euderus* and *Chelonus* and *Apanteles dignus*, Mues.

Callan (E. McC.). **Fumigation of Insect Pests in stored Produce.**—*Trop. Agriculture* **19** no. 5 pp. 87–91. Trinidad, 1942.

The author gives a brief account of methods of fumigating grain and other stored products for the control of insect pests, and describes the properties and the use of the commoner fumigants, including hydrocyanic acid gas, ethylene oxide, chloropicrin, ethylene dichloride, carbon bisulphide, carbon tetrachloride and methyl bromide, and the precautions to be taken with each of them.

Phillips (J. H. H.). **Three Strains of Cucumber Mosaic occurring on Tobacco in Ontario and Quebec.**—*Canad. J. Res.* (C) **20** no. 6 pp. 329–335, 1 pl., 11 refs. Ottawa, 1942.

An account is given of investigations in Ontario on three strains of cucumber mosaic [*Marmor cucumeris* of Holmes] that affect tobacco in Ontario and Quebec. It was found that this disease spread much more rapidly than tobacco mosaic [*M. tabaci* of Holmes] and that the situation of infected plants could not be correlated with the soil or with cultural practices. Observations indicated that infection was more likely to be due to insect vectors, especially since the Aphid, *Macrosiphum solanifolii*, Ashm. (*gei*, auct.), occurs commonly on tobacco in Ontario in which the virus was found and, in limited tests, readily transmitted cucumber mosaic to this host.

Wheeler (N. H.). **Trap-light Studies on Leafhoppers of the Genus *Empoasca* (Homoptera : Cicadellidae), 1932–1941.**—*Proc. ent. Soc. Wash.* **44** no. 4 pp. 69–72, 7 refs. Washington, D.C., 1942.

The data obtained from observations on species of *Empoasca* taken in two light-traps operated at Arlington, Virginia, each year from 1932 to 1941 inclusive, some of the results of which have already been noticed [*R.A.E.*, A **25** 678], are summarised and discussed. Of the 60,938 specimens taken during the

whole period, 34,876 were males ; 30 species were determined from examination of 29,528 males, and the maximum number of species represented during a single season was 21. The commonest were *E. fabae*, Harr. (24,953 males), *E. erigeron*, DeLong (2,685), *E. pergandei*, Gill. (558), *E. alboneura*, Gill. (239) and *E. solana*, DeLong (201). Twelve species not previously taken in field collections were obtained by means of the trap-lights, the value of which for obtaining a large variety of species and determining the time of occurrence and the relative abundance of the species present was demonstrated.

E. fabae was caught earlier than the first week in May only in 1938, when a male was taken on 19th April, and this is regarded as a further indication that this species migrates northward each season [**20** 523] ; previous observations on the significance of young oak and hickory foliage in this migration [**24** 181] were confirmed. The period of maximum abundance of *E. fabae* began each year in mid-June, and in 1940 two males were taken as late as 22nd November ; this was the latest date on which any example of the genus was taken, with the exception of an undetermined female on 29th November 1934. The data concerning the variety of species obtained and the proportions of the most abundant species correspond with those obtained from similar traps operated by H. H. Walkden in Kansas and W. W. Stanley in Tennessee ; in both these States, *E. fabae* was found to be the commonest species and to reach its maximum abundance in June and July.

PATCH (L. H.). **Height of Corn as a Factor in Egg Laying by the European Corn Borer Moth in the One-generation Area.**—*J. agric. Res.* **64** no. 9 pp. 503–515, 3 figs., 2 refs. Washington, D.C., 1942.

The following is based on the author's summary. In the area in which *Pyrausta nubilalis*, Hb., has one generation a year, investigators have found that plots of tall maize always contain more egg-masses than plots of short maize. Because of the relation of height to time of planting, this fact is important when control measures are being considered. A study was therefore made of the distribution of egg-masses among fields of maize over county-wide areas. The egg-masses were counted on 30 plants in each of 10 fields taken at random in each of 160 unit areas in Michigan, Ohio and New York in 1930-33. A unit area was usually a third of a county or a group of two counties. The average plant height during the oviposition period was determined for each field.

Data from unit areas within which all the fields examined were infested showed that factors such as situation of the unit areas and year in which the data were obtained did not affect the distribution of egg-masses among the fields within the unit areas. The mean level of maize height, however, was found to have a marked effect on the distribution of egg-masses among the fields. More were laid in the fields of tall maize within an area than in the fields of short maize, but the difference was less marked in areas where the general level was high. When the maize within unit areas averaged 32·4 inches in height, 8·3 times as many egg-masses were laid in the fields of tallest maize as in the fields of shortest maize, whereas in unit areas in which the maize averaged 69·4 inches at the time of moth flight, only 1·7 times as many egg-masses were counted in the fields of tallest maize. When the data were grouped on the basis of counties without regard to the unit areas within them, about twice as many egg-masses were found in the counties in which the maize was above the average in height as in those in which it was below the average. In a discussion of possible reasons for this condition, it is pointed out that the larger numbers of egg-masses in areas of tall maize were not preceded by higher autumn populations of borers. Moths were found to be attracted as much more to fields of tall maize than to fields of short maize, as they were to plots of tall maize than to plots of short maize within experimental fields.

QUAYLE (H. J.). **Control of Citrus Insects and Mites.**—*Circ. Calif. agric. Ext. Serv.* no. 123, 31 pp., 7 figs., 15 refs. Berkeley, Calif., 1941. [Recd. 1943.]

The pests of *Citrus* in California include five important Coccids, of which *Aonidiella aurantii*, Mask., *A. citrina*, Coq., and *Lepidosaphes beckii*, Newm., cause more direct injury than *Saissetia oleae*, Bern., and *Coccus pseudomagnoliarum*, Kuw., apparently because they have a more toxic salivary secretion. The measures employed against them comprise fumigation with hydrocyanic acid gas and spraying with oil at a concentration of 1·66 per cent. The spray can be prepared with emulsive oil (containing an oil-soluble emulsifier) or with 2 per cent. of a stock emulsion having a water-soluble emulsifier and containing 80–85 per cent. oil. The oil can be rendered more effective or effective at a lower concentration by the addition of rotenone extracts [*R.A.E.*, A **28** 617; **29** 349]. In general, oranges can be fumigated from mid-December until the end of February and from the end of July until October, and lemons from December until the end of April. Orange trees are best sprayed in August and September, though Valencia oranges may be sprayed in November if a light-medium oil is used; lemons are sprayed in October and November and will tolerate a heavier oil than oranges.

Fumigation is the best single treatment against *A. aurantii*, even where a resistant strain is present; the dosages against such strains [*cf.* **29** 410], which are the highest tolerated by the trees, are 24–28 cc. in winter and 20–24 cc. in summer-autumn for oranges and 24–28 cc. for lemons in the interior districts, and 20–24, 16–20 and 22–24 cc., respectively, in the coastal districts. For intensive control, two treatments separated by a short interval, which should be about 30 days in summer, when the life-cycle occupies about 75 days, are applied. The resistance of the Coccid varies at different stages in its life-cycle, and individuals that are resistant at the time of the first fumigation are likely to be susceptible at the second. The dosages recommended against the non-resistant strain on orange are 16–20 cc. in coastal districts and 20–24 cc. in the interior; the same or slightly higher dosages are used on lemons. A spray of medium or heavy-medium oil applied to lemons in October–November is effective against light infestations of *A. aurantii* and also against *Paratetranychus citri*, McG., and if applied in April or May, after the old fruit has been harvested, will hold the latter in check until autumn. Oil sprays are likely to be still more effective against *A. citrina*, since it does not occur on old wood. If heavy infestations of *A. aurantii* persist, it may be necessary to spray and fumigate the trees, the treatments being separated by an interval of one or two weeks or of several months; on lemon, fumigation may precede the spray. If the Coccid continues to increase in spite of previous measures, treatment should be repeated at short intervals for a year or two, a high dosage being used in at least one fumigation, preferably in winter.

A light-medium oil spray is effective against *S. oleae* on orange, and where *A. aurantii* is also present, a medium oil can be used on orange as well as on lemon except in the interior, although in the intermediate region (eastern Los Angeles County) this involves some risk of water-spot on navel oranges. *S. oleae* is also controlled by fumigation at dosages of 18–22 cc. during late July or early August and the succeeding two or three months in the interior, where there is one generation a year, and at 16–18 cc. at midsummer and again in mid-winter in coastal districts, where there are two. In warm districts, sulphur dusts applied not later than June maintain populations at levels sufficiently low to enable the interval between spraying and fumigation to be prolonged and destroy young Coccids that appear early. *L. beckii*, which is found only in the southern coastal areas and is often associated with *S. oleae*, is best controlled by fumigation at 18–20 cc. in August and September, although treatment may be carried out from July to November, but spraying with light-medium or medium oil may also be necessary. Winter fumigation has not

proved satisfactory. Similar measures are employed against *L. gloveri*, Pack., which occurs in a restricted area. Against *C. pseudomagnoliarum*, which is most injurious in inland districts and has become resistant to HCN over a wide area, light-medium oil sprays applied during August or September afford the best protection ; where *S. oleae* is not also present, the oil can be used at a concentration of only 1·5 per cent. Fumigation may be desirable against this species in central California, especially where it occurs together with *A. citrina*, against which summer and winter dosages of 20–24 and 22–24 cc., respectively, are required in the interior, and, where possible, of at least 18 cc. in coastal areas. *C. pseudomagnoliarum* and in certain districts light infestations of *A. citrina* can be kept in check by means of sulphur dusts. *C. hesperidum*, L., is usually restricted to isolated trees, and infestations generally disappear quickly, owing probably to the influence of parasites. If control of this species or of mealybugs is necessary, *Iridomyrmex humilis*, Mayr, which feeds on their honey-dew and interferes with their natural enemies, should be destroyed, by means of a poison bait containing $\frac{1}{4}$ oz. tartaric acid, $\frac{1}{3}$ oz. sodium benzoate, $\frac{3}{4}$ oz. sodium arsenite, 12 lb. granulated sugar and 2 lb. strained honey in 11 U.S. pints water. The mealybugs that attack *Citrus* in California are *Pseudococcus gahani*, Green, *P. citri*, Risso, *P. adonidum*, L. (*longispinus*, Targ.) and *P. maritimus*, Ehrh., but they are of little importance.

Paratetranychus citri is the only important mite on *Citrus* in the State. It can be controlled by means of a special dust [**30** 346] and by the oil sprays recommended against Coccids. The effect of the latter is prolonged by using heavy oils, but when the spray is applied in spring against the mite alone, light oils should be used to avoid injury to the tree. *Eriophyes sheldoni*, Ewing, has become of importance on lemons in some districts in recent years and is controlled by the oil spray used against *S. oleae* or by an inverted one containing sulphur [**30** 601], which, however, cannot be applied later than March without risk of injury to the tree. *Tetranychus sexmaculatus*, Ril., and *Phyllocoptruta oleivorus*, Ashm., are local pests ; the former can be controlled by the measures used against *Paratetranychus citri* and the latter by sulphur dusts.

Scirtothrips citri, Moult., which was for many years injurious chiefly to navel orange, has recently extended its range and become an important pest of lemon in some districts. It can be controlled on orange by three applications of sulphur dust at the rate of 1, $\frac{3}{4}$ and $\frac{1}{2}$ lb. per tree between 20th March and 10th April, 20th April and 1st May, and 25th May and 7th June, respectively ; in southern California, the first application can generally be omitted. Other control measures [*cf.* **27** 460] include the use of sprays containing equal quantities of tartar emetic and sugar. The formulae are 2 lb. of each per 100 U.S. gals. when applied at a rate of $2\frac{1}{2}$ U.S. gals. per tree by a boom sprayer or broom guns and 15 lb. of each when applied at 20 U.S. gals. per acre from a spray duster for lemons, and half these concentrations, with the same rates of application, for orange and grapefruit. Orange and grapefruit should be sprayed just after petal fall and again, if necessary, in August. A first spray on lemons should be applied when the thrips appear in numbers, usually in May or June, and a second at the end of July or in August ; a third in the autumn may be necessary in some years. The weaker spray for lemons can also be used on nursery stock. If *C. pseudomagnoliarum* is also present, 2–3 applications of sulphur dust should be made at intervals of 2–3 weeks, the first in May or June after the tartar-emetic spray ; the use of a spray-duster may make it possible to apply the dust and the spray in one operation. *Heliothrips haemorrhoidalis*, Bch., has recently become a more general pest in part of San Diego County and is best controlled by means of a spray containing 1·66 per cent. oil with the addition of $\frac{1}{4}$–$\frac{1}{2}$ pint pyrethrum extract per 100 gals. The extract contains the equivalent of 20 lb. pyrethrum flowers (0·9 to 1·0 per cent. pyrethrins) in 1 U.S. gal. kerosene. The trees are sprayed in autumn, and an application of an oil

spray containing ¾ U.S. pint pyrethrum extract and 8 oz. blood albumin per 100 U.S. gals. may be necessary within 20–30 days. A spring application of a spray containing ½–¾ gal. light-medium oil and ¼–½ pint pyrethrum extract may also be desirable, but if Aphids are also present, ¾ pint nicotine sulphate should be substituted for the pyrethrum extract. Two other thrips, *Frankliniella occidentalis*, Perg., and *Hercothrips fasciatus*, Perg., also occur on *Citrus*, but cause little or no injury to it.

Damage to the leaves by adults of *Pantomorus godmani*, Crotch, may be severe on recently budded trees or interplants ; the roots are attacked by the larvae. Cryolite dusts or sprays are effective against the weevils, and young trees can be protected by adhesive bands applied to the trunk over a coating of grafting wax, or by bands of cotton batting tied round the trunk by a string round the lower edge, the top then being pulled down over the string to form a trap. The trees should be shaken to dislodge any weevils on them before the bands are applied. *Empoasca fabae*, Harr., can be controlled on navel oranges by a repellent spray containing 15 lb. zinc sulphate, 50 lb. hydrated lime, and water to make 300 U.S. gals. [*cf.* **28** 616] ; on Valencia orange, the amount of hydrated lime is doubled.

Other insect pests of *Citrus* are *Tortrix* (*Argyrotaenia*) *citrana*, Fern. [*cf.* next abstract], and the Aphids, *Aphis spiraecola*, Patch, *A. gossypii*, Glov., *Toxoptera aurantii*, Boy., and *Myzus persicae*, Sulz., which are injurious in coastal and sometimes in intermediate districts in spring and early summer and are controlled by dusts and sprays of nicotine sulphate, or, if *Aonidiella aurantii* is also present, by a spray of nicotine sulphate and lime-sulphur.

Boyce (A. M.). **Control of Orange Tortrix.**—*Calif. Citrogr.* **27** no. 8 p. 219, 3 figs. Los Angeles, Calif., 1942.

A brief account is given of the bionomics of *Tortrix* (*Argyrotaenia*) *citrana*, Fern., and the type of damage that it causes to orange fruits in California [*cf. R.A.E.*, A **28** 121] and of measures recommended against it. Cryolite, applied at the rate of ½ lb. per tree in a dust, or as a spray, gives satisfactory control. If the Tortricid occurs alone, a 50 per cent. cryolite dust is applied at the rate of 1 lb. per tree ; when *Scirtothrips citri*, Moult., is also present, a 2 : 3 mixture of cryolite and 325-mesh sulphur is applied at 1¼ lb. per tree, or a 1 : 2 mixture at 1½ lb. if a higher dosage of sulphur is required. Cryolite can also be included in DN-Dust [containing 1 per cent. dinitro-ortho-cyclohexylphenol (*cf.* **30** 346)] for the control of *T. citrana* and *Paratetranychus citri*, McG., and in a mixture of DN-Dust and sulphur for the control of all three pests. It is seldom practicable to apply cryolite as a spray solely for the control of *T. citrana*, and it is incompatible with lime-sulphur, though not with wettable sulphur. It can effectively be used at the rate of 3 lb. per 100 U.S. gals. in a spray of nicotine sulphate against Aphids or in one of pyrethrum extract against *Heliothrips haemorrhoidalis*, Bch., and at 1 lb. per 100 U.S. gals., or according to the oil manufacturer's recommendation, in the regular oil sprays against Coccids and mites.

On navel oranges, cryolite applied in a dust mixture during late May and early June prevents fruit-drop in autumn and winter and also largely eliminates the scarring by the small larvae between the buttons of the young fruit. It may, however, be applied at any time during the summer in dusts or oil sprays to protect the fruit in autumn and winter. On Valencia oranges, treatment is necessary in late May or June to prevent the drop of ripe fruit during summer, and, if applied early enough, it prevents the scarring under the buttons of the young fruit to a considerable extent. The cryolite can be included in oil sprays applied in late summer and early autumn to prevent fruit-drop during autumn and winter, but this may not be practical, as loss of Valencia fruits in autumn and winter has been less important than loss in summer during recent years.

Frampton (V. L.), Linn (M. B.) & Hansing (E. D.). **The Spread of Virus Diseases of the Yellows Type under Field Conditions.**—*Phytopathology* **32** no. 9 pp. 799–808, 6 figs., 4 refs. Lancaster, Pa., 1942.

The authors derive a differential equation describing the spread of viruses of the yellows type by insects under field conditions in terms of the percentage of plants infected, the time, and the distance from the source of infection, based on the assumptions that the movement of the insects involved is random, that the number of plants that become infected is proportional to the number that have been fed on, and that spread from plant to plant within the field is of small importance. The equation is integrated in accordance with the conditions that the insect population in the newly ploughed field is negligible, that the insect reservoir is not substantially depleted during the course of the experiment, and that the effects at the ends of the field are neglected.

Data obtained in several field experiments carried out in New York on the dissemination of yellow dwarf of potatoes [*Marmor vastans* of Holmes] into potato fields and of aster yellows [*Chlorogenus callistephi* var. *vulgaris* of Holmes] into endive and lettuce beds by leaf-hoppers [*Aceratagallia sanguinolenta*, Prov., and *Macrosteles divisus*, Uhl., respectively] showed that the logarithm of the percentage infection was proportional to the distance into the field and to the sum of the time and the logarithm of the time, both of which relationships satisfy the integrated equation.

Sokoloff (V. P.) & Klotz (L. J.). **Attempts at Mass Infection of California Citrus Red Scale with Bacteria.**—*Phytopathology* **32** no. 9 p. 829. Lancaster, Pa., 1942.

Approximately 5×10^{12} spores of the bacterium that has been shown capable of attacking the red scale [*Aonidiella aurantii*, Mask.] on *Citrus* in California [*cf. R.A.E.*, A **30** 305, etc.] were sprayed and dusted over lemon trees in two field trials carried out in September and December 1941. A demonstrable increase in mortality of the scale was noted on leaves, green bark and fruits of the treated trees. The density of the red-scale population decreased significantly on the infected trees, parallel with the decreased percentage survival. In the December experiment, a premature mortality developed among the scales throughout the two-acre grove, on the 60th-70th day, whereupon differences between the controls and the infected trees had disappeared. The micro-organism used in the experiment and some other species of the genus *Bacillus* could be isolated invariably from the prematurely dead adults and grey adults in sections of the grove far removed from the site of the experiments. Among other organisms associated with the premature death of the scale were some common, apparently non-pathogenic, fungi and a species of *Actinomyces*.

Telford (H. S.). **Wireworm Injury and Potato Varieties.**—*Bi-m. Bull. N. Dak. agric. Exp. Sta.* **4** no. 5 pp. 7–8, 2 refs. Fargo, N. Dak., 1942.

As preliminary observations in North Dakota had indicated that certain varieties of potato were more subject to attack by larvae of *Corymbites* (*Ludius*) *aeripennis destructor*, Brown, than others, plot tests were carried out with eight varieties in infested soil in 1940 and 1941, and field observations were made on the three most commonly grown. From the results obtained, it appeared that wireworm injury is greater in the varieties that have fewer tubers per hill and have these growing closer to each other; a commonly grown variety that has many widely-scattered tubers was the least damaged in all cases. The author recommends that the less susceptible varieties should be grown where serious wireworm infestation is known to occur, but points out that the use of clean summer fallow [*cf. R.A.E.*, A **30** 520] is one of the principal means of reducing injury.

Shotwell (R. L.). **Evaluation of Baits and Bait Ingredients used in Grasshopper Control.**—*Tech. Bull. U. S. Dep. Agric.* no. 793, 51 pp., 6 figs., 21 refs. Washington, D.C., 1942.

This is a critical survey of information on the relative value of various substances suggested for use in poison baits against grasshoppers in the United States. It covers the experimental data unpublished and published up to 1938 that lend themselves to statistical analysis. A brief history of the use and testing of poison baits in the United States, and a description of the methods of evaluating baits, as well as the statistical methods of analysing the results, are given. An analysis of the author's own results and of those of others [*R.A.E.*, A **10** 45, 46 ; **11** 134 ; **12** 301 ; **15** 545] proves that molasses, lemons, amyl acetate, sodium and calcium chlorides, whey and other attractants increase the cost of baits but not their effectiveness. Many control campaigns in which baits without any attractants were used were successful, though many extension workers continued to use attractants because farmers believe in their value. Experiments with carriers show that bran is superior to sawdust, but a mixture of equal parts of bran and sawdust is just as effective. In drier regions, the proportion of sawdust to bran may be increased to 3 : 1, and in extremely dry conditions wet sawdust alone may be used. The addition of sawdust to bran prevents the bait from lumping and helps its more uniform spread. Dry bran is as satisfactory as wet bran when sodium fluosilicate is used as the poison. Beet-pulp baits are less attractive than bran baits, but not sufficiently so to preclude their use when cost and availability come into account [**23** 96]. Comparison of poisons [**10** 46 ; **14** 77 ; **15** 545 ; **23** 96] shows that liquid sodium arsenite, crude white arsenic and Paris green are equally effective, and better than dry sodium arsenite. Sodium fluosilicate kills more rapidly and is less harmful to man and animals, but is not superior to arsenicals in final result. Barium fluosilicate is less effective. The quantities of poison recommended per 100 lb. bran are 5 lb. white arsenic, $2\frac{1}{2}$ lb. dry sodium arsenite, 2 U.S. quarts liquid sodium arsenite (containing 4 lb. arsenic trioxide per U.S. gal.) and 4 lb. sodium or barium fluosilicate. Paris green is not recommended because of its high cost. Baits in which mineral oil is used to keep them soft longer [**22** 277] are not significantly less effective than baits with molasses ; they were more effective after 1–5 days, though not in all the tests. Strong-smelling crude oils were as satisfactory as the more refined oils. Field tests on a large scale, however, suggest that the interaction between crude oil and white arsenic may render the bait ineffective, and more work is required with oil baits before they can be recommended for general use, although 3,088 tons of such baits were applied with good results in 1937 in Illinois.

In appraising the results obtained with baits, it is of importance to bear in mind the mobility of grasshopper populations. Daily changes in the population of unbaited plots amount to 51–245 per cent. of the original number, and this fluctuation may greatly affect the apparent results of field experiments and of the actual campaign in single fields.

The methods of mixing and spreading baits, as well as of making grasshopper surveys [**23** 473], and precautions in handling baits are described. Reduction in the areas to be baited by soil cultivation is discussed, and it is concluded that ploughing prevents hatching and reduces the area to be baited by 80–90 per cent. Disking does not prevent hatching but reduces the population ; stubbled-in crops become foci of infestation.

Pepper (B. B.). **The Carrot Weevil, *Listronotus latiusculus* (Bohe.), in New Jersey and its Control.**—*Bull. N. J. agric. Exp. Sta.* no. 693, 20 pp., 7 figs., 13 refs. New Brunswick, N.J., 1942.

Much of the information in this bulletin on the bionomics and control of *Listronotus latiusculus*, Boh., on celery in New Jersey, where it has recently

become a very serious pest on this crop, carrots and parsley, has already been noticed [*R.A.E.*, A **26** 565]. Damage to celery grown on muck soil has varied from 0 to 90 per cent., and that to carrot and parsley varies from field to field, but at least 25 per cent. of the carrots in one area were killed or severely damaged during 1938–41 ; damage to parsley is less obvious. There are two complete generations and a partial third during the year in the north of the State and three complete and a partial fourth in the south, but they overlap to such an extent that all stages may be found in the field from late May until October. Adults are usually present by the time carrots and parsley are an inch high and celery is transplanted into the field ; oviposition begins about 20th April in the south of the State and about 1st May in the north, 1–10 eggs being deposited in hollows excavated in the stalks by the females. As many as 23 cavities have been observed in a single celery plant and 16 in a carrot plant, with totals of 93 and 51 eggs, respectively. Eggs of the first and later generations hatch in 9–16 and 5–11 days ; in very small carrots and parsley, the young larvae go immediately to the roots, and they may tunnel out the entire roots of young carrots. The larval, prepupal and pupal stages last 11–19, 1–5 and 7–13 days, and the adults remain in the pupal cells for 1–5 days and feed for 5–10 days before oviposition begins ; some lived as long as 104 days in summer, when suppplied with food and moisture.

Control by burning the hibernation quarters or applying oil sprays to them was unsuccessful in celery fields. Sprays and dusts of lead and calcium arsenate and sprays of Paris green and cryolite, applied to growing celery in 1937–39, were more effective against the adults than a dust of phenothiazine, which was the best of the organic compounds tested in 1936–38 [*cf.* **26** 566] ; sprays containing 4 lb. lead or calcium arsenate, 8 lb. lime and 1 lb. powdered skim milk per 100 U.S. gals. gave 85·6 and 84·5 per cent. reduction in injury, respectively, and dusts of lead or calcium arsenate and lime (1 : 3) 80·3 and 78·1 per cent. Although the sprays were more effective than the dusts, power sprayers are probably too heavy for use on muck farms. Some of the baits tested in 1937–41 were more effective than any of the other treatments [*cf. loc. cit.*], and directions are given for making a cheap one containing 5 lb. calcium arsenate and 95 lb. dried apple pomace (apple dried commercially by vinegar manufacturers and used as a source of pectin by the preserving industry), which is recommended, though it was less effective than some of the others. This bait also gave good control on carrots and parsley. It should be broadcast at the rate of 40 50 lb. per acre every 15–20 days and scattered between the crop and the hibernating quarters of the weevils if these are known.

KLOSTERMEYER (E. C.). **The Alfalfa Plant Bug** (*Adelphocoris lineolatus* **Goeze) in Nebraska (Hemiptera ; Miridae).**—*J. Kans. ent. Soc.* **15** no. 3 p. 92. Manhattan, Kans., 1942.

In Nebraska, *Adelphocoris lineolatus*, Goeze, was collected at light in 1936 and swept from lucerne in 1940, and it was numerous at light throughout the summer of 1941, when adults and nymphs were found on lucerne, potatoes and beans and two adults on wheat. Sweeps in a five-acre lucerne field showed a gradual increase in population during the summer to a maximum of 37 adults and nymphs per 100 sweeps on 9th September ; on 4th October, only one individual per 100 sweeps was collected. In view of the high population that developed in this limited area, it is considered that this Capsid may become an important pest of lucerne in the middle-western States.

HORSFALL (W. R.). **Biology of the Squash Blister Beetle.**—*J. Kans. ent. Soc.* **15** no. 3 pp. 93–99, 3 refs. Manhattan, Kans., 1942.

An account is given of observations in 1939–41 on the bionomics of *Henous confertus*, Say, which did important damage in gardens, particularly near

meadowland or open woods, in north-western Arkansas in 1939 and limited damage in 1940. Injury was most serious in gardens adjacent to favoured oviposition sites of *Melanoplus differentialis*, Thos., and *M. bivittatus*, Say. This Meloid occurs from the Rocky Mountains to the Mississippi River and from South Dakota to the Gulf of Mexico. In Arkansas, one complete generation and a partial second occur in outbreak years. The adults, which cannot fly, feed principally on pollen, but destroy all parts of the flowers of several species of cucurbits, lucerne and the wild western daisy, *Bellis integrifolia*, and also attack the fruits of squash and tomato, which were damaged considerably in 1939. They are present from late May until early October and were most abundant in June and July in 1940 and 1941. The females deposit 35–224 eggs, the number depending on their diet, in a shallow tubular cavity in the ground [*cf. R.A.E.*, A **30** 599], which they seal with soil. At normal temperatures, the larvae hatch in 16–26 days and pass through five active instars, preying on the egg-pods of *M. differentialis*, *M. bivittatus* and other grasshoppers that oviposit earlier in the season, after which they burrow into the soil and pupate or enter the sixth (coarctate) instar [*cf.* **30** 600]. Under field conditions, many larvae that find suitable food in June or early July pass through the five instars rapidly, pupate and become adults in the same season, whereas other early larvae and all those that complete their feeding in August and early September pass into the coarctate form and remain dormant until the next spring, when they change to the seventh (active) instar and pupate. Those that begin to feed late in the year develop slowly through the autumn and early winter, become coarctate larvae in spring, change to the seventh instar in late summer and pupate normally ; some of them may not moult until the following year if conditions are unfavourable. Coarctate larvae are very resistant to desiccation and may survive for two or three years before developing further, and a return from the seventh instar to the coarctate state was occasionally observed in the laboratory when the larva was subjected to abnormally dry conditions; regular development followed when favourable moisture conditions were renewed. In field cages, 28 larvae consumed about 37 eggs of *M. differentialis* each ; two or three may develop to maturity in a single egg mass at different times or in different parts. The pupal stage, which was never found during winter, lasted 10–15 days, and the adults live 4–6 weeks.

BUGBEE (R. E.). **Damage to Kernels of Wheat by *Harpalus amputatus* Say, in western Kansas.**—*J. Kans. ent. Soc.* **15** no. 3 p. 108, 4 refs. Manhattan, Kans., 1942.

In October 1941, adults of the Carabid, *Harpalus amputatus*, Say, were reported to be present in enormous numbers in western Kansas and causing considerable damage to shallow-sown wheat by gnawing the kernels. This is the first known record of such damage in the State, though it is reported that a similar attack, probably by the same species, occurred about 14 years earlier in the same neighbourhood.

CHAMBERLIN (F. S.) & MADDEN (A. H.). **Insect Pests of Cigar-type Tobaccos in the southern Districts.**—*Circ. U. S. Dep. Agric.* no. 639, 54 pp., 57 figs. Washington, D.C., 1942.

The following is based on the authors' summary of this detailed account of the habits and control of the insects that attack cigar types of tobacco in the parts of Florida and Georgia in which they are chiefly cultivated. In this area, the wrapper leaf is grown under artificial shade, and the binder leaf and filler leaf in the open field. The insects attack all types of tobacco, but the wrapper leaf suffers the most serious deterioration in value. The commonest pests in the plant beds are the mole-crickets, *Scapteriscus acletus*, Rehn & Heb., and *S. vicinus*, Scud., the flea-beetles, *Epitrix parvula*, F., and *E. cucumeris*,

Harr., and cutworms. Flea-beetles can be controlled by dusts of cubé or derris diluted to contain 1 per cent. rotenone, and much of the injury caused by mole-crickets and cutworms can be prevented by the application of poison-bran bait.

The three most important insect pests of the crop in the field are the tobacco budworm, *Heliothis virescens*, F., the tobacco hornworm, *Protoparce sexta*, Joh., and *E. parvula*. *H. virescens* can be controlled by a bait of maize meal and lead arsenate (75 : 1 by weight) applied directly to the bud leaves ; the number of applications necessary to protect the crop will vary with the type of tobacco. The most effectual means of controlling *Protoparce* on wrapper tobacco is the careful maintenance of the cloth tops, side walls and gateways of the shade structures, but its control on field tobacco is difficult, as no poison that is entirely satisfactory against it is available. Light applications of Paris green alone or mixed with hydrated lime are usually fairly effective, but there is considerable risk of scorching the foliage. Hand-picking of the larvae can frequently be carried out where the acreage is limited, and the destruction of tobacco plants immediately after harvest and autumn ploughing reduces the population. Both preventive and direct control measures should be used against flea-beetles, which cause the most serious injury to wrapper tobacco. Weeds near tobacco fields should be removed, and all tobacco stalks completely destroyed immediately after the crop is harvested ; a mixture of cubé or derris and sterilised tobacco dust, containing 1 per cent. rotenone, should be applied soon after the plants are set and at approximately weekly intervals. Field tobacco in this region is also attacked by several species of cutworms, of which the most common are *Feltia subterranea*, F., *Agrotis ypsilon*, Hfn., and *F.* (*A.*) *malefida*, Gn., and by various grasshoppers. No entirely satisfactory means is known of controlling the tobacco thrips, *Frankliniella fusca*, Hinds, which causes injury to cigar-wrapper tobacco during abnormally dry growing seasons.

Brief notes are given on insects that are usually only minor pests, including *Nezara viridula*, L., *Dicyphus minimus*, Uhl., *Halticus citri*, Ashm., the wireworms, *Heterodercs laurenti*, Guér., *Drasterius mellillus*, Say (*Aeolus dorsalis*, Say) and *Conoderus* (*Monocrepidius*) sp., of which the first is the most common, the climbing cutworms, *Peridroma saucia*, Hb. (*margaritosa*, Haw.) and *Prodenia ornithogalli*, Gn., and the tobacco splitworm, *Gnorimoschema operculella*, Zell., and on others that are occasionally found feeding on tobacco.

Chandler (S. C.) & Flint (W. P.). **Control of Roundheaded Apple Tree Borer.** —*Circ. Ill. nat. Hist. Surv.* no. 40, 8 pp., 6 figs., 1 ref. Urbana, Ill., 1942.

The authors discuss the damage caused by larvae of *Saperda candida*, F., to apple trees in Illinois and describe attempts to evolve a chemical method of control and render unnecessary the mechanical removal of the borers [*cf. R.A.E.*, A **25** 39]. Infestation by this Lamiid tends to be localised and is frequently confined to part of an orchard that is near woods containing wild food-plants ; in such situations, many trees are greatly weakened or killed. Mating and oviposition occur during June and July in Illinois, where the life-cycle lasts two years ; the eggs are laid in slits in the bark near the ground, and the larvae enter chiefly at the base of the tree and tunnel up or down for a few inches ; the young larvae work near the surface of the bark, but the older ones enter the sapwood and heartwood. The flow of sap is cut off and the tree partly or completely girdled. Infestation is usually less severe in orchards that are regularly sprayed [*cf.* **29** 243], since some of the adults are killed while feeding on foliage and twigs.

Preliminary tests in October 1935 showed that removing the soil from the base of the trees, painting the injured areas with 1 U.S. pint of an emulsion of 2 oz. paradichlorobenzene and ½ U.S. pint Dendrol (a miscible oil) made up to 1 or 2 U.S. pints with water and replacing the soil without mounding resulted in 61·9 and 27·3 per cent. mortality, respectively, as compared with 7·7 per cent.

in the control, and did not injure the trees. In 1938–39, ethylene-dichloride emulsion killed all the borers at strengths of 10–50 per cent., but damaged the trees severely. It gave no control at 5 per cent. In 1939–41, pouring ½ U.S. pint of an emulsion of carbon bisulphide (20 per cent.) and fish-oil soap or the same quantity of the weaker emulsion of paradichlorobenzene round the base of the tree in autumn to touch the bark and then mounding the trees gave an average of 81·7 and 89·9 per cent. mortality, respectively, on trees 6–22 ins. in circumference, but injecting unemulsified carbon bisulphide into the galleries and covering the openings with a little earth gave an average of only 53·1 per cent., possibly because some holes were missed, much less material was used than in the other treatments, and the lack of mounds allowed the gas to escape too quickly. Of the trees that received the three treatments, 31, 11 and 24 per cent., respectively, showed browned areas, which were more extensive on those treated with carbon bisulphide, but the injury was not permanent. The authors consider that the paradichlorobenzene treatment is the most promising and should be as effective in spring as in autumn, provided that the temperature of the soil one inch below the surface is not less than 55°F.; they describe the methods of preparing this material and the carbon-bisulphide emulsion.

Alden (C. H.). **Apple Insects and Diseases.**—*Bull. Ga Dep. Ent.* no. 83, 39 pp., 17 figs. Atlanta, Ga., 1942.

This bulletin is a revision of a previous one dealing with the pests and diseases of apple in Georgia and their control [*R.A.E.*, A **21** 190]. Three Jassids, *Empoasca fabae*, Harr., *E. maligna*, Walsh, and *Typhlocyba* (*E.*) *rosae*, L., of which the first is the most abundant and injurious, are added to the list of minor pests, and the information on control is brought up to date.

Bianchi (F. A.). **Thysanoptera and Aphididae new to the Island of Midway.**—*Proc. Hawaii. ent. Soc.* **11** no. 1 p. 37. Honolulu, 1941. [Recd. December 1942.]

The author gives a list of two Aphids and four thrips found on the island of Midway, of which only *Aphis medicaginis*, Koch, which was collected from the heads and foliage of isolated clumps of lucerne, has previously been recorded there. It includes *Aphis gossypii*, Glov., which was very abundant on French marigolds [*Tagetes*], on which the large colonies were parasitised to a considerable extent by the Braconid, *Lysiphlebus testaceipes*, Cress.; *Thrips hawaiiensis*, Morg., scattered individuals of which were collected from flowers of lucerne and *Leucaena glauca*; and *T. tabaci*, Lind., which is abundant and causes considerable damage to carnations and other flowers and to onions.

Fullaway (D. T.). **A Check List of the parasitic Hymenoptera of the Samoan Islands with Descriptions of new Species appended.**—*Proc. Hawaii. ent. Soc.* **11** no. 1 pp. 41–49. Honolulu, 1941. [Recd. December 1942.]

The new species described comprise six Braconids and include *Apanteles agonoxenae*, from four females reared from the larvae of *Agonoxena argaula*, Meyr., on *Clinostigma oncorhyncha*.

Zimmerman (E. C.). **The Bostrichidae found in Hawaii (Coleoptera).**—*Proc. Hawaii. ent. Soc.* **11** no. 1 pp. 103–108. Honolulu, 1941. [Recd. December 1942.]

Keys are given to eight species of Bostrychids that have been recorded from the Hawaiian Islands, none of which is indigenous. Those that are apparently established there are *Dinoderus minutus*, F., which has been bred from bamboo furniture; *Rhizopertha dominica*, F., from maize and dog biscuits; *Amphicerus*

cornutus, Pall., from *Hibiscus* spp., algaroba [*Ceratonia siliqua*] and several other plants ; *Xylothrips religiosus*, Boisd., from dead *Hibiscus* and avocado ; *Xylopsocus castanoptera*, Fairm., from the stems of pigeon pea [*Cajanus cajan*], avocado, *Ceratonia siliqua*, etc. ; *X. capucinus*, F., of which a single adult has been taken ; and *Sinoxylon conigerum*, Gerst., from Malvaceae, *Ceratonia siliqua*, avocado and *Cajanus cajan*. The last-named also bores holes through the lead sheathing of telephone cables throughout the Islands, permitting the entrance of water, which causes short circuits. *Polycaon stouti*, Lec., has been occasionally bred from furniture imported from western North America, but is not known to reproduce in Hawaii.

ZIMMERMAN (E. C.). **Argentine Ant in Hawaii.**—*Proc. Hawaii. ent. Soc.* **11** no. 1 p. 108. Honolulu, 1941. [Recd. December 1942.]

Iridomyrmex humilis, Mayr, which is commonly intercepted in goods coming from California, was found established in the Hawaiian Islands for the first time in 1940 at Fort Shafter, Honolulu, where it had been troublesome in houses since the late spring or early summer and had formed numerous strongly developed colonies. The shallow nests were common in the soil round the bases of trees, under rubbish and in débris in cavities in trees. Where *I. humilis* was numerous, other ants, particularly *Pheidole megacephala*, F., were scarce or absent.

MUGGERIDGE (J.). **Wireworms.**—*N. Z. J. Agric.* **64** no. 5 pp. 321, 323–324, 3 figs., 3 refs. Wellington, N.Z., 1942.

A total of 147 species of wireworms, of which three are introduced, have been recorded from New Zealand, where, however, they are not a major pest. Ten records of damage to crops, including maize, vegetables and tobacco, have been received during the past ten years, but injury at present attributed to other causes may prove to be due to wireworms, and it has been suggested that the deterioration of pastures is at least partly due to them. Notes based on work in other countries are given on their bionomics and control.

GOLDING (F. D.). **The Wild Silkworms of Nigeria.**—*Fm & For.* **3** no. 1 pp. 35–40, 7 refs. Ibadan, 1942.

In view of the increased demand for the silk from the nests and cocoons of Notodontids that occur in Nigeria, an account is given of previous attempts to produce the silk on a commercial scale, and the best methods of obtaining it, together with notes on the bionomics of *Anaphe infracta*, Wlsm., which with *Epanaphe* (*A.*) *moloneyi*, Druce, is the most important species [*cf. R.A.E.*, A **12** 68], and characters distinguishing the adults and the larval nests of the chief species. These are *A. infracta* and *A. venata*, Btlr., which are thought to be confined to the Southern Provinces, *E.* (*A.*) *vuilleti*, de Joann., thought to be confined to the Northern Provinces, *A. ambrizia*, Btlr., which occurs in orchard bush country, and *E. moloneyi*, which is widely distributed. Larvae of *A. infracta* feed on *Bridelia micrantha* and *Albizzia* sp., and those of *E. moloneyi* on *Isoberlinia doka*, *Ficus platyphylla*, *Albizzia gummifera*, *A. zygia* and possibly also on *Cordia millenii* in one district. The food-plants of *A. venata*, *A. ambrizia* and *E. vuilleti* are *Triplochiton scleroxylon*, *B. ferruginea* and *F. platyphylla*, respectively, and the first species is believed to feed on *B. micrantha* in one district. In the Northern Provinces, the highest quality silk is obtained from cocoons spun by larvae tentatively determined as *Hypsoides* sp. that feed on *Tamarindus indica*.

Females of *A. infracta* deposit eggs in groups of 170–250 on the lower surface of the leaves of the food-plant. There are eight larval instars, and the egg,

larval, pre-pupal and pupal stages occupy 18–56 days, about 12 weeks, 98–122 days, and about 4 months, respectively. About 80 per cent. of the adults emerge in May and June, about 10 per cent. in November, and about 10 per cent. in January, February, April, July or August.

Hopkins (J. C. F.) & Cuthbertson (A.). **How to prevent Waste. Hints on the Control of Diseases and Pests.**—*Rhod. agric. J.* **39** no. 3 pp. 192–201. Salisbury, S. Rhod., 1942.

The authors point out that the yield of vegetable crops in Southern Rhodesia could be substantially increased by the control of pests and diseases, and that the cost of the appropriate measures would be more than offset by the increase obtained. The methods advocated include the immediate destruction of all refuse and weeds, in which insects breed, adequate cultivation to ensure rapid and vigorous growth of the plants, and direct measures, including disinfecting seed and spraying the plants with insecticides and fungicides. A classified list of useful spray materials , methods of preparing some of the commoner sprays and a table showing the kinds of pests and diseases that attack the principal crops, the nature of the injury they cause, and suitable control measures, are appended.

Le Pelley (R. H.). **A Method of sampling Thrips Populations.**—*Bull. ent. Res.* **33** pt. 3 pp. 147–148. London, 1942.

In the course of studies in Kenya on *Diarthrothrips coffeae*, Williams, which lives chiefly on the leaves of coffee, but also feeds on the green shoots and berries, it was found necessary to develop a method of sampling the populations, since counting the thrips on the leaves proved difficult and inaccurate, and sampling methods previously described [*R.A.E.*, A **14** 637; **21** 625] were unsatisfactory. The method adopted makes use of filter paper treated with a blue-print solution and a negative consisting of tracing cloth on which parallel lines are drawn in Indian ink. The leaves to be sampled are dipped into 70 per cent. alcohol, the alcohol is filtered through the printed paper, and the thrips, which show up clearly against the dark background, are counted under a low-power microscope. The filter paper and alcohol can both be used many times. Other advantages are that practically the whole of the population is secured, any number of leaves can be used in the samples, and the thrips can be left in the alcohol as long as desired before examination. The numbers of thrips obtained from 20 leaves by this method were 1½–3 times as many as those obtained by the method of Evans [**21** 625].

Sellers (W. F.). **The Distribution of the European Spruce Sawfly, *Diprion polytomum* (Htg.) in the Scandinavian and eastern Baltic Countries.**—*Bull. ent. Res.* **33** pt. 3 pp. 149–159, 1 pl., 1 fig., 1 ref. London, 1942.

In view of the serious outbreak of the introduced European spruce sawfly, *Diprion polytomum*, Htg.,* that began in North America in 1930, collections of the sawfly were made in Europe in an attempt to discover natural enemies that could be liberated in North America. It is present wherever spruce grows, but is relatively scarce, and collections were made chiefly in Czechoslovakia, where it was slightly more abundant. In 1938 it was thought desirable to

*It has recently been found that the spruce sawfly introduced into North America is *Gilpinia hercyniae*, Htg., and not *G.* (*D.*) *polytoma*. The two species appear to have a similar distribution in Europe [*cf. R.A.E.*, A **29** 474; **30** 341], so that both may be included in the records given in this paper. References to red larvae in the material indicate that it included the true *G. polytoma*, since Smith, in investigations already noticed [**29** 474], found that red coloration in the larvae is a recessive character.—*Ed.*

discover more profitable collecting grounds, and surveys were therefore made during the spring and summer of that year in Denmark, Norway, Sweden, Finland, Estonia, Latvia and Lithuania. The results obtained in each country are summarised and discussed with reference to the prevailing bioclimatic conditions.

The sawfly was found on spruce throughout an area extending from latitude 55°N. to latitude 68° 45′ N., which is shown on a map and in which spruce occurs over 25–40 per cent. of the productive forest land. The optimum bioclimatic conditions were found to be those providing the maximum moisture, heat from the sun and shelter, and these occur most frequently near the upper limits of the range of the food-plant in the Arctic areas and at high altitudes in central Europe. Distribution is likely to be sporadic in the mountains, and numbers are likely to be great there only where local conditions permit of concentrations of heat. In the high mountainous districts of central and south-eastern Europe and in northern Sweden and Finland, the period of growth does not permit the development of more than one complete generation a year, whereas elsewhere there are two. The larvae were more abundant in areas having one than in those having two generations, where all the favourable conditions rarely occur together. During the survey, large collections of larvae were made in Sweden and Finland for shipment to Canada ; details are given in tables.

Jones (M. G.). **The Summer Hosts of** *Aphis fabae*, **Scop.**—*Bull. ent. Res.* **33** pt. 3 pp. 161–165. London, 1942.

Experiments on the preferences of *Aphis fabae*, Scop., for different summer food-plants were carried out at Cambridge with a view to the possibility of using them to protect crops. Uninfested summer food-plants were planted in a circle approximately 18 ins. in radius round small bushes of *Euonymus europaeus*, on which fundatrices from *Euonymus* sp. were placed. *Viburnum opulus* was also used as the winter food-plant, but only two of the seven bushes became established. The summer food-plants tested were broad bean, sugar-beet, including both seed and crop plants, poppy (*Papaver rhoeas*), *Chenopodium album*, dock (*Rumex obtusifolius*) and *Cirsium arvense* ; *Arctium lappa*, *Solanum nigrum* and *Capsella bursa-pastoris* were also included in some plots.

In nearly all the plots, broad bean was the first summer food-plant to be colonised, followed by sugar-beet, which was in some cases colonised at the same time. Dock, poppy and *Chenopodium* were not attacked in any definite order, but all three were attacked before *Cirsium*. *Arctium* and *Solanum* were colonised and *Capsella* was not, but the numbers of these plants were too small for the results to be significant. Further investigation took place rapidly by means of the apterae, which migrate actively when the food-plant becomes overcrowded or is in poor condition and colonise plants at random. The size of the colonies founded on the summer food-plants varied from plot to plot and from plant to plant, but tended to confirm the general order of preference. There was no indication of the presence of biological races on different food-plants. As bean and sugar-beet are the preferred food-plants, they cannot be protected by using any others as trap-plants, but it might be possible to protect seed sugar-beet from heavy initial infestation by planting the headlands with beans and destroying them after they have become infested.

Perkins (J. F.). **On a new Species of** *Ephialtes* **(Hym., Ichneumonidae) parasitising the Codling Moth.**—*Bull. ent. Res.* **33** pt. 3 pp. 171–174, 6 refs. London, 1942.

Descriptions are given of both sexes of *Ephialtes cydiae*, sp. n., which was reared from *Cydia pomonella*, L., in France and also occurs in Germany, together with notes on the synonymy of other species included in *Ephialtes* by the author.

WIGGLESWORTH (V. B.). **Some Notes on the Integument of Insects in Relation to the Entry of Contact Insecticides.**—*Bull. ent. Res.* **33** pt. 3 pp. 205–218, 6 figs., 20 refs. London, 1942.

The following is largely the author's summary of investigations on the bearing of certain structural and physiological features of the insect cuticle on the entry of insecticides, particularly of extracts of pyrethrum in oil, some of the results of which have already been noticed [*R.A.E.*, A **29** 240]. Insects immersed in oils exude droplets of water on the surface of the cuticle [*loc. cit.*], but there is a delay in their appearance if heavy oils are used that varies in duration at different parts. There is no delay if the lipoid layer of the epicuticle is first extracted with petroleum ether. Factors controlling the rate of entry of pyrethrum through the cuticle were studied by the application of pyrethrum in oil to a restricted area of the abdomen of nymphs and adults of the Triatomid, *Rhodnius prolixus*, Stål. The pyrethrum entered more rapidly when in light than in heavy petroleum oils, and its rate of entry was much accelerated when the cuticle was first treated with petroleum ether; it was very slow when vegetable oils were used [*cf.* B **31** 5]. The rate of entry varied greatly among individual insects, chiefly owing to differences in the thickness of the endocuticle, which is determined by the size of the meal taken before moulting, the age and the amount of food taken after moulting, and the degree of stretching of the cuticle. There is evidence that the pore canals are important in the passage of pyrethrum through the endocuticle, which probably offers the chief resistance.

Histological examination showed that in the nymphs, oils are taken up first by the epidermal cells in the zone round the bristles, and later by the general epidermis. The amount of oil absorbed is greatly increased when 5 per cent. oleic acid is added to refined petroleum. In adults that have recently moulted, oils are taken up by the general epidermis, and in old insects they are absorbed only by the dermal glands; there is no evidence of absorption through the sockets of the bristles. The rate of entry of pyrethrum in oils through the cuticle of the nymphs is accelerated by the addition of oleic or other fatty acids, but this effect is less pronounced in the adults.

[ZAKHVATKIN (A. A.).] **Захваткин (А. А.). Key to Mites injuring Stores of agricultural Products in U.S.S.R.** [*In Russian.*]—*Uchen. Zap. mosk. gosud. Univ.* no. 42 Zool. pp. 7–68, 142 figs. Moscow, 1940. [Recd. December 1942.]

This paper was published to supersede a preliminary one [*R.A.E.*, A **26** 95], and almost all the information in it is included in the author's subsequent monograph [**30** 416]. Some changes are made in the nomenclature adopted in his previous papers [**26** 94, 95]. *Lepidoglyphus* is considered to be a subgenus of *Glycyphagus*; *Eberhardia* and *Cosmoglyphus* are regarded as congeneric with *Acotyledon*; the name *Gohieria*, Oudm. 1939, is adopted for *Ferminia*, Oudm. 1928, which is preoccupied [in birds]; *Monieziella entomophaga*, Lab., is referred to the allied genus *Thyreophagus*, of which it is the type; and the name *Tyrophagus longior*, Gerv., is adopted for the mite previously called *T. putrescentiae*, Schr, which is considered unrecognisable. In the author's view, the name *T. dimidiatus*, Herm., which has also been used for this mite, is referable to one or other of the field species of the group of *T. humerosus*, Oudm.

[RODENDORF (B. B.).] **Родендорф (Б. Б.). Key to the Cheyletidae and Pediculoididae.** [*In Russian.*]—*Uchen. Zap. mosk. gosud. Univ.* no. 42 Zool. pp. 69–98, 37 figs. Moscow, 1940. [Recd. December 1942.]

This paper includes descriptions of, and keys to, the genera and species of Cheyletid mites that have been recorded in the Russian Union, and a description

of *Pediculoides ventricosus*, Newp., the only member of its family found in barns there. Records are given of the distribution of the species, six of which are new.

[Bekker (É. G.).] **Беккер (Э. Г.).** ***Acaromyces glycyphagi*, gen. et sp. n., a Parasite of the Mite, *Glycyphagus destructor*, Schrank.** [*In Russian.*]—*Uchen. Zap. mosk. gosud. Univ.* no. 42 Zool. pp. 113–128, 31 figs., 45 refs. Moscow, 1940. [Recd. December 1942.]

A description is given of *Acaromyces glycyphagi*, gen. et sp. n., a yeast that was found in the body cavity and digestive tract of examples of *Glycyphagus destructor*, Schr., in a laboratory culture in Moscow, together with the results of a detailed study of its development and the way in which it reaches the body cavity from the digestive tract. A high rate of mortality occurred among the mites, but it is not known whether this was due to the yeast. It is possible that the latter is a beneficial symbiont.

[Rodionov (Z. S.).] **Родионов (З. С.). The qualitative and quantitative Damage caused by Grain Mites.** [*In Russian.*]—*Uchen. Zap. mosk. gosud. Univ.* no. 42 Zool. pp. 141–165, 3 figs., 16 refs. Moscow, 1940. [Recd. December 1942.]

The following is based on the author's conclusions from his own detailed investigations, which are described, and those of other workers. The severity of the infestation of stored grain by mites in the Russian Union is due to improper methods of harvesting, threshing and storage, and varies with the condition of the grain. Broken or injured grains are particularly liable to infestation, and experiments have shown that mites do not attack those with intact seed-covers [*R.A.E.*, A **25** 130], even under conditions of optimum temperature and high humidity. In tests with dry and moist wheat, only the predacious mite, *Cheyletus eruditus*, Schr., survived in grain of which the moisture content was below 12 per cent., but *Glycyphagus destructor*, Schr., *Tyroglyphus farinae*, DeG., and *Tyrophagus noxius*, Zkhv., could develop when the moisture content was only a little higher. At moisture contents above 14 per cent., all species of grain mites become abundant. Excessive humidity of the stored grain is caused partly by the practice of harvesting grain of various degrees of ripeness at the same time and also by the fact that the harvested grain is not sufficiently cleared of weeds. The distribution of the mites in the grain varies with the changes that occur in its temperature and humidity at different levels, since they concentrate in places that are favourable [**26** 96]. Grain that has been damaged by the larvae of *Calandra granaria*, L., *C. oryzae*, L., or *Tinea granella*, L., and is contaminated by their excreta is particularly liable to attack by mites, since the excreta tend to raise its moisture content.

In laboratory experiments, small quantities of flour and grain, of which the moisture content was 14 and 18 per cent., respectively, artificially infested with *Tyroglyphus farinae* at the rate of about 682 mites per lb. and kept at 20–21°C. [68–69·8°F.] for 30 days, showed practically no loss of weight, but the quality of the flour was considerably reduced. Severe infestation by mites is usually accompanied by a mass development of micro-organisms, especially fungi and moulds, which they disseminate [see next abstract].

Passing the grain through cleaning machines and separators removes over 95 per cent. of the insects and mites in it, their excreta and other débris, but some survive inside the seeds, and efforts should be made to increase the effectiveness of the cleaning process before milling.

[Sigrianskiĭ (A. M.).] **Сигрианский (А. М.). Granary Mites as Vectors of Diseases of agricultural Plants.** [*In Russian.*]—*Uchen. Zap. mosk. gosud. Univ.* no. 42 Zool. pp. 167–177, 20 refs. Moscow, 1940. [Recd. December 1942.]

In view of references in the literature to mites as vectors of micro-organisms injurious to stored products, laboratory investigations were carried out in Moscow with *Tyrophagus noxius*, Zkhv., as the test mite. In the experiments, if fed readily on the spores of *Tilletia tritici*, which adhered to its body and hairs, and transmitted them to healthy wheat. Mites that had fed on onions infected with *Botrytis allii* transmitted the spores to healthy onions, and when mites were given access to potato tubers from plants infected with a virus disease and to healthy tubers, the virus was subsequently detected in the shoots that grew from the latter. Various moulds and other saprophytic micro-organisms were transmitted to grain and flour by mites that had developed on naturally infected media. The mites fed readily on pure cultures of *Alternaria tenuis*, *T. tritici* and *Fusarium solani* and multiplied rapidly. The spores of all these adhered equally well to the body, and *Alternaria* and *Tilletia* were recovered from the stomachs and excreta of the mites. In a few cases, spores of *Alternaria* from the excreta were shown to be viable. It is concluded that micro-organisms are disseminated among stored products by mites and facilitate the feeding of the latter by their action on the substratum.

[Kozulina (O. V.]. **Козулина (О. В.). The Effect of Humidity and Temperature on the Development of the Eggs of Grain Mites.** [*In Russian.*]—*Uchen. Zap. mosk. gosud. Univ.* no. 42 Zool. pp. 179–184, 5 graphs, 11 refs. Moscow, 1940. [Recd. December 1942].

Eggs of *Tyroglyphus farinae*, DeG., and *Tyrophagus noxius*, Zkhv., deposited in the laboratory were subjected to percentage relative humidities of 30–100 at room temperature (20–22°C. [68–71·6°F.]). The humidities at which hatching began and reached its maximum were 55 and 70 for *noxius* and 60 and 100 for *farinae*. The greater resistance of the former to low humidity is possibly due to the thicker tegument of the egg. Eggs of both species survived prolonged immersion in water, the percentage that hatched averaging 80·43 for *farinae* and 100 for *noxius*. When batches of freshly laid eggs were kept for 1, 3, 5 and 10 days at 50 per cent. humidity and then at 100 per cent., the percentages that hatched were 80·88, 34, 3·71 and 0, respectively, for *farinae* and 98·2, 90, 76 and 0·9 for *noxius*. When the eggs were kept for 1–5 days at 100 per cent. humidity and then transferred to 40 or 50 per cent., none of those of *farinae* hatched, whereas a few of those of *noxius* did so after exposure to the high humidity for 3 days, and almost all after exposures of 4–5 days.

In field experiments carried out by V. I. Stepanova in 1937 to ascertain whether the mites can survive the winter in soil under snow, cultures of the mites in grain were placed in bottles stopped with cotton-wool and buried in the ground at various depths; two bottles were examined two months after the temperature fell below freezing point, and all stages of *farinae* were found alive, but only the eggs of *noxius*. The remaining bottles were examined in spring (5 months after they had been buried), and it was found that only the eggs and hypopi of *farinae* had survived.

In the laboratory, the eggs of *farinae* developed at 30°C. [86°F.] and those of *noxius* at 35°C. [95°F.]. In tests to determine the effect of fluctuating temperatures, the percentage hatch was not affected by exposure to 30–35 and 16–17°C. [60·8–62·6°F.] on alternate days, but was reduced to 10 for *farinae* and 74 for *noxius* when the range was from 0 to 16–19°C. [32 to 60·8–66·2°F.] and 0 for both mites when it was from 0 to 30°C. Exposure to 0°C. for 24 hours killed 70–92·5 per cent. of the eggs of *farinae* 3–4 days old, but very

few of those of *noxius*; older eggs of both species were more resistant. It is concluded from these tests that a fall in the temperature of the grain during winter retards the development of the eggs and may kill some of them.

[Polezhaev (V. G.).] **Полежаев (В. Г.). The Effect of Atmospheric Humidity and Temperature on the Formation of the Hypopial Stage in *Glycyphagus destructor*, Schr., and *Tyroglyphus farinae*, L.** [*In Russian.*]—*Uchen. Zap. mosk. gosud. Univ.* no. 42 Zool. pp. 185–196, 4 graphs, 9 refs. Moscow, 1940. [Recd. December 1942.]

In further investigations on the factors influencing the formation of hypopi in granary mites [*cf. R.A.E.*, A **27** 585], no hypopi of *Tyroglyphus farinae*, DeG., appeared at any of the combinations of temperature and relative humidity (2–30°C. [35·6–86°F.] and 40–100 per cent.) at which this mite was reared. The optimum conditions for its development were temperatures of 17–25°C. [62·6–77°F.] and relative humidities of 60 100 per cent., provided that the higher temperatures were accompanied by the higher humidities. High temperature and low humidity or high humidity and low temperature was less favourable.

In the case of *Glycyphagus destructor*, Schr., hypopi were scarce or absent under conditions that were optimum for the development of the mite (23°C. [73·4°F.] and a relative humidity of 80 per cent.), but became more numerous throughout the year as these conditions deviated from the optimum. No hypopi were formed at a humidity of 40 per cent.; at humidities of 60, 80 and 100 per cent. they appeared at temperatures of 20, 26 and 17°C. [68, 78·8 and 62·6°F.], respectively, and were most numerous at 20, 30 and 20°C.

Observations from July to the end of November showed that the transformation of the hypopi into second-stage nymphs depended on temperature and humidity, the optimum conditions for it being 20°C. and humidities of 40–100 per cent. At higher temperatures, the nymphs appeared only at humidities of 80 and 100 per cent., but at temperatures below 20°C., transformation also occurred at lower humidities. No nymphs appeared at 12°C. [53·6°F.] irrespective of humidity. There were considerably fewer second-stage nymphs in winter, the hypopi apparently being in a state of diapause.

The results of the laboratory experiments were confirmed by examination of infested grain from 42 granaries in Moscow. The average temperature of the grain ranged from 17 to 21°C. [62·6–69·8°F.] and the relative humidity of the air from 45 to 95 per cent. in different months. The percentage of samples containing mites increased with the relative humidity, and the percentage of samples that contained hypopi of *G. destructor* was greatest at 45–55 and 85–95 per cent. and least at 65–75 per cent. A decrease in relative humidity in conjunction with high temperature reduced the abundance of the mites but favoured the appearance of hypopi. As conditions approached the optimum (20°C. and 80 per cent. humidity), the reverse was observed.

In winter, when the temperature of the grain ranged from 3·2 to –7°C. [37·75–19·4°F.], hypopi were the only stage found, thus constituting a source of reinfestation in spring. If they are present, the grain and the granaries should be fumigated at temperatures above 12°C., at which most of them transform into the second-stage nymph.

[Rodionov (Z. S.) & Furman (A. V.).] **Родионов (З. С.) и Фурман (А. В.). Interrelations between the phytophagous and predacious Mites.** [*In Russian.*]—*Uchen. Zap. mosk. gosud. Univ.* no. 42 Zool. pp. 197–201, 4 refs. Moscow, 1940. [Recd. December 1942.]

The value of the predacious mite, *Cheyletus eruditus*, Schr., in the control of granary mites (chiefly *Tyroglyphus farinae*, DeG., *Tyrophagus noxius*, Zkhv., and *Glycyphagus destructor*, Schr.) was studied in Moscow. Observations showed

that the females of all these mites lay approximately the same number of eggs, but that that of *Cheyletus* requires about 20 days to develop from egg to adult and the granary mites 5–8 days less. When single individuals of *Cheyletus* were confined with wheat in test tubes and 10 examples of *Tyroglyphus farinae* added daily for 12 days, the latter were destroyed at the rate of 3-4 per day. Further experiments showed that the activity of *Cheyletus* depended on the nature, temperature and humidity of the substratum and varied with the number of granary mites present. When it was kept for three months in jars containing materials infested by *Tyrophagus noxius*, it became much more abundant in the jars containing whole grain than in those containing broken grain, bran or flour, while the reverse occurred with *T. noxius*, and it is concluded that granary mites are less exposed to it in bran and particularly flour. The immature forms attacked only the immature grain mites, but the adults attacked the immature stages only when adults were absent. The hypopi of *Glycyphagus destructor* and *Caloglyphus rodionovi*, Zkhv., were not attacked. *Cheyletus* also fed on the adults of *Troctes* sp. infesting stored rye. When deprived of food and kept singly, the mites died in 11–13 days, but under crowded conditions in a small quantity of grain, they fed on one another. *Cheyletus* was more resistant to desiccation than the granary mites; when confined at only 30–35 per cent. relative humidity, it survived for 4–5 days, whereas the granary mites died within 48 hours. It was more susceptible to fumigation with hydrocyanic acid gas, however.

On the basis of these investigations, the authors conclude that *Cheyletus* is not of great value for the control of grain mites and that its presence only lowers the purity of the grain.

[Petrova (G. I.).] **Петрова (Г. И.). Determination of the Infestation of Flour and Groats by Mites.** [*In Russian.*]—*Uchen. Zap. mosk. gosud. Univ.* no. 42 Zool. pp. 203–209, 1 fig., 4 refs. Moscow, 1940. [Recd. December 1942.]

In Russia, the ordinary method of determining the degree to which grain or coarse groats are infested by mites is to shake samples on a sieve and count the numbers retained. Flour and fine groats are poured on to a smooth surface so as to form small pyramids, and the blunting of the apex in a few hours is considered indicative of the presence of mites; or flour is placed in a glass tumbler and exposed to light for 10–12 hours, the presence of the mites being indicated by the tunnels made by them through the flour pressed against the sides of the tumbler. Defects in these methods are pointed out, and an apparatus similar to one already noticed [*R.A.E.*, A **27** 318] is described, by means of which it was possible to recover in 25 minutes 85–92 per cent. of the mites with which small samples of flour were infested. The necessary heat was obtained from an electric bulb, or from an electric heater or hot sand but as the last two gave an uneven heat, an iron plate was placed between them and the flour to keep the temperature more regular. The mites abandoned finely ground flour more quickly than coarse flour. The initial temperature of the flour, which in the tests varied from 10 to 25°C. [50–77°F.], had no effect on the numbers of the mites that left it, or on the rapidity with which they did so.

[Smirnov (E. S.) & Polezhaev (V. G.).] **Смирнов (Е. С.) и Полежаев (В. Г.). The Reaction of the Hypopus of the hairy Mite (*Glycyphagus destructor* Schr.) to Hydrogen Cyanide and Chloropicrin.** [*In Russian.*]—*Uchen. Zap. mosk. gosud. Univ.* no. 42 Zool. pp. 211–219, 2 refs. Moscow, 1940. (With a Summary in German.) [Recd. December 1942.]

It is stated in an appendix to this paper, the rest of which has already been noticed [*R.A.E.*, A **25** 266], that fumigation with chloropicrin at the rate of 1 oz. per 50 cu. ft. gave complete mortality of hypopi of *Glycyphagus destructor*,

Schr., when the period of exposure was 3 days and the temperature 16°C. [60·8°F.]. At higher temperatures the necessary period of exposure was considerably reduced.

[Stepanova (V. I.).] **Степанова (В. И.). Contribution to the Method of fumigating Grain with Chloropicrin.** [*In Russian.*]—*Uchen. Zap. mosk. gosud. Univ.* no. 42 Zool. pp. 221–226, 2 figs., 6 refs. Moscow, 1940. [Recd. December 1942.]

In view of the poor penetrating power of chloropicrin, this fumigant is generally applied to stored grain in Russia by means of wooden tubes that are thrust into the heaps and contain wicks on to which the liquid is poured ; the vapour diffuses into the grain through holes along the tube. The experiments described in detail in this paper were carried out to test the diffusion obtained by this method. The tube was inserted into the middle of a box of grain, with a glass front, containing adults of *Calandra granaria*, L., in test tubes at equal vertical and horizontal distances from one another. All the weevils died, and the results are given as the time within which they did so. They died first near the top of the middle row, where the fumigant was first introduced, and last at the points furthest removed from the tube. When the fumigant was sprinkled on a cloth placed over the grain, death occurred first in the layer immediately beneath the cloth. Observations on the concentration of the fumigant showed that it was least at the top and greatest at the bottom of the boxes. It is concluded that the tubes should have more holes in them than is at present the case, and that they should not be thrust to less than about a yard from the bottom of the heaps.

[Kozulina (O.).] **Козулина (О.). Déplacement des différentes espèces de tiques sur les divers substratums.** [*In Russian.*]—*Uchen. Zap. mosk. gosud. Univ.* no. 42 Zool. pp. 271–277, 1 graph, 5 figs., 10 refs. Moscow, 1940. (With a Summary in French.) [Recd. December 1942.]

The rapidity with which mites that occur in grain, flour or other stored products move about was studied in Moscow by recording the movements of mites for 3 minutes on plywood, writing paper, wax paper, glass or flour. The average distance covered increased in *Chortoglyphus arcuatus*, Troup., *Tyroglyphus farinae*, DeG., *Tyrophagus noxius* Zkhv., *Glycyphagus destructor*, Schr., *Cheyletus eruditus*, Schr., and *G. michaeli*, Oudm., in the order named. The rapidity with which the mites moved depended on their size, the length and structure of the legs and the nature of the surface. *Cheyletus eruditus* moved more quickly on rough surfaces than on smooth ones, but the reverse was true of *Tyrophagus noxius*, which has pads on the extremity of the tarsi. *T. noxius* and *G. michaeli* moved in an almost straight line, but the others wandered at random. This is of practical importance, because while *Chortoglyphus arcuatus* would move only 7 8 ins. away from the initial point in an hour, *Tyrophagus noxius* would cover about 8 ft. in the same period, and *G. michaeli* a distance of up to 20 ft.

[Bulanova (E. M.).] **Буланова (Е. М.). Sur la propagation endozoique des tyroglyphes par les souris.** [*In Russian.*]—*Uchen. Zap. mosk. gosud. Univ.* no. 42 Zool. pp. 279 282. Moscow, 1940. (With a Summary in French.) [Recd. December 1942.]

As it has been found that grain mites are transported on the fur of rodents and the feathers of birds [*R.A.E.*, A **27** 552], experiments were carried out in Moscow to determine whether they can also be disseminated in the excreta of

animals that have fed on infested material. For this purpose mice were fed on wheat, flour or dough artificially infested with Tyroglyphids in various stages. The results showed that 95, 50 and 30 per cent. of the eggs of *Tyrophagus noxius*, Zkhv., *Caloglyphus rodionovi*, Zkhv., and *Tyroglyphus farinae*, DeG., recovered from the excreta were viable and that at least one immobile hypopus of *Glycyphagus destructor*, Schr., survived; several others appeared normal, but had not transformed to the following stage by the time of writing. It was observed that the eggs hatched best when placed in water. No other stages survived.

Dosse (G.). **Beiträge zum Massenwechsel des Rapserdflohs** (*Psylliodes chrysocephala* **L.**). [Contributions to the Variation in Abundance of the Rape Flea-beetle, *P. chrysocephala*.]—*Z. PflKrankh.* **52** pt. 7–8 pp. 353–373, 5 figs., 15 refs. Stuttgart, 1942.

Nearly all investigations on the variation in abundance of *Psylliodes chrysocephala*, L., on rape in Germany have been made in the northern and central regions, and observations there have shown that rape sown early or very late usually escapes injury or is only slightly infested. Cold and lack of moisture are unfavourable to the Halticid, and the severe winter of 1939–40 terminated an outbreak [*R.A.E.*, A **30** 208]. The investigations described in this paper were made in 1939–41 in several localities in Württemberg at an altitude of about 1,200-2,400 ft., including two with poor, stony soil and an inclement climate, the average annual temperature being 6°C. [42·8°F.]. A detailed account of the work is given, and the following is based on the author's summary. Although the larval population was severely reduced by the cold winter weather, the numbers of larvae present in the spring of 1941 were considerable. Most of these doubtless hatched from overwintered eggs, and the latter appeared to have been more numerous than the eggs that hatched in autumn. Few adult females survived the winter of 1940–41, and the larvae that hatched in large numbers in May were too numerous to have been the offspring of overwintered adults. By the end of May, infestation was as severe as it had been in the previous autumn, and even more so on some varieties of rape. Early sown fields were those most severely attacked.

Wahl (B.). **Wald- und Weinbeschädigungen durch die Buchenwaldheuschrecke.** [*Podisma alpina* var. *collina*, Brunn., causing Injury in Forests and Vineyards.]—*Z. PflKrankh.* **52** pt. 7–8 pp. 382–389, 1 fig., 5 refs. Stuttgart, 1942.

In Austria, especially in Styria, *Podisma alpina*, Koll., var. *collina*, Brunn., occasionally becomes very numerous, but such outbreaks have hitherto been limited to local infestations resulting in defoliation of beech, ash and other trees. The literature on these infestations is reviewed. With the exception of one record referring to ash, all the outbreaks have occurred in beech forests. From forests, this Acridid sometimes migrates to cultivated land, and it has attacked grape-vines, potatoes, beans and other crops. It was found experimentally that a spray containing 0·07 per cent. nicotine and 2 per cent. soft soap affords good control, but its use is seldom warranted or practicable.

Thode (K.). **Versuche zur chemischen Bekämpfung von** *Sitona lineata* **L.** [Experiments in the chemical Control of *S. lineatus*.]—Inaug.-Diss., Bonn, 56 pp. Würzburg, 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 7–8 pp. 416–417. Stuttgart, 1942.)

An account is given of laboratory and field experiments in Germany in 1937–38 on the control of *Sitona lineatus*, L. In the laboratory tests, adult

weevils collected in the field were allowed to feed on pea foliage sprayed or dusted with stomach and contact poisons. Good results were given by sprays of Paris green or pyrethrum and by dusts of calcium arsenate. The only treatments effective in the field were a spray of 0·25 per cent. Paris green and 1·5 per cent. lime applied at the rate of about 66 gals. per acre, and a commercial calcium-arsenate dust used at the rate of about 9 lb. per acre.

Gösswald (K.). **Beobachtungen über den Schutz eines Kiefernbestandes vor der Kiefernbuschhornblattwespe** *Diprion* (*Lophyrus*) *pini* **L. durch die rote Waldameise.** [Observations on the Protection of Pines against the Pine Sawfly by the red Forest Ant.]—*Z. Forst- u. Jagdw.* **72** pp. 370–378. 1940. (Abstr. in *Z. PflKrankh.* **52** pt. 7–8 p. 420. Stuttgart, 1942.)

Owing to the secretion of a sticky liquid, the larvae of *Diprion pini*, L., are not readily preyed upon by ants, but they are attacked by all three forms of the red forest ant, *Formica rufa*, L. In a severely infested stand of old pines in Prussia, a strong colony of the large form of *F. rufa rufo-pratensis*, Forel, prevented defoliation within a radius of 300–500 yards. Colonies of the small form of this variety liberated in another stand became numerous enough to afford control before the sawfly had passed through two generations. This form is specially suited to check *D. pini*, because both it and the sawfly prefer open stands. The meadow ant, *F. rufa pratensis*, Retz., does not prey on the sawfly larvae and may prevent the forest ants from attacking them in the vicinity of its nest.

Gäbler (H.). **Die Kleine Fichtenblattwespe** *Lygaeonematus pini* **Retz.** (*Nematus abietinus* **Christ), ihre Prognose und die Aussichten für ihre Bekämpfung.** [The Lesser Spruce Sawfly, *Pristiphora abietina*, Christ; forecasting Abundance and Prospects of Control.]—*Tharandt. forstl. Jb.* **91** pp. 646–686. 1940. (Abstr. in *Z. PflKrankh.* **52** pt. 7–8 pp. 420–421. Stuttgart, 1942.)

Injury to spruce by *Pristiphora abietina*, Christ (*Lygaeonematus pini*, Retz.) has increased of recent years in Germany, and defoliation over a considerable period leads to reduction in growth. The forecasting of the abundance of the sawfly is based chiefly on the collection of cocoons in spring, just before adult emergence, and on an analysis of their condition. Factors causing mortality in the cocoon stage include predacious Carabids, wireworms (especially *Athous subfuscus*, Müll.) and parasitic Hymenoptera. Control is difficult owing to the shortness of the larval stage and the presence of different instars at the same time. Insecticides can be applied with success during a period of only a few days, and weather is then the decisive factor. Estimation of the results is difficult because the dead larvae remain hanging among the needles. A proprietary dust of pyrethrum and derris and another of dinitro-ortho-cresol gave good results in laboratory tests, but were not satisfactory in the field owing to unfavourable weather, especially rain. Dusting from an aeroplane is preferable to power dusting, especially in the case of thickets.

Götz (B.). **Beiträge zur Analyse des Mottenfluges bei den Traubenwicklern** *Clysia ambiguella* **und** *Polychrosis botrana*. [Contributions to the Analysis of Adult Flight in the Vine Moths, *Clysiana ambiguella* and *P. botrana*.]—*Wein u. Rebe* **23** pp. 207–228. 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 7–8 pp. 422–423. Stuttgart, 1942.)

Using special apparatus, the author has ascertained the time, temperature and air humidity at which *Clysiana* (*Clysia*) *ambiguella*, Hb., and *Polychrosis*

botrana, Schiff., pair and oviposit. *C. ambiguella* pairs in the early morning, with a peak between 3 and 5 a.m., and *P. botrana* in the evening, with a peak between 9 and 10 p.m. Both species oviposit from mid-day until dusk, and very few eggs are laid in the morning. *C. ambiguella* flies to bait chiefly during the night. In both species, adult flight is connected with pairing, oviposition and feeding, but there is also a flight with no apparent object, which may contribute to increase metabolic action and consequently maturation. Both moths become active at 12–13°C. [53·6–55·4°F.], with a marked increase in activity at 15°C. [59°F.] and above.

Nolte (H. W.). **Beiträge zur Biologie und Morphologie der Raubwanze *Troilus luridus* F.** [Contributions to the Biology and Morphology of *T. luridus*.]—*Tharandt. forstl. Jb.* **91** pp. 202–216. 1940. (Abstr. in *Z. PflKrankh.* **52** pt. 7–8 p. 432. Stuttgart, 1942.)

An account is given of the morphology, distribution and bionomics of *Troilus luridus*, F., in Germany, with special reference to its feeding habits. This Pentatomid is predacious on insects of many species, including the larvae of *Lymantria monacha*, L. Insects that are merely punctured by the bug and not fed on usually die. It is voracious, and although vegetable food is not necessary for its development, it has been reared to the adult stage on it. It has no great influence in the control of forest pests, and is unlikely to prove of much value against *Leptinotarsa decemlineata*, Say, on potato [*R.A.E.*, A **29** 70].

Lasaroff (A. W.). **The Moroccan Locust, *Dociostaurus maroccanus*, Thnb., in Bulgaria in 1939.** [*In Bulgarian with a Summary in German.*]—*Mitt. bulg. ent. Ges.* **11** pp. 65–74. Sofia, 1940. (Abstr. in *Z. PflKrankh.* **52** pt. 7–8 p. 424. Stuttgart, 1942.)

In 1939, *Dociostaurus maroccanus*, Thnb., was the most harmful locust in Bulgaria. Others were *Calliptamus* (*Caloptenus*) *italicus*, L., *Decticus verrucivorus*, L., *Locusta migratoria*, L., and species of *Isophya* and *Poecilimon*. Cultivated plants suffered less than wild ones. Control measures were carried out by 50,000 people, and 70–90 per cent. were destroyed by flame-throwers, baits of wheat bran poisoned with Paris green and other means.

Lasaroff (A. W.). **Untersuchungen über die echten Schildläuse (Diaspinae, Coccidae) der Obstbäume in Bulgarien.** [Investigations on the Diaspine Coccids infesting Fruit Trees in Bulgaria.]—Separate, 46 pp. Sofia, 1940. (Abstr. in *Z. PflKrankh.* **52** pt. 7–8 p. 428. Stuttgart, 1942.)

The Diaspine Coccids observed by the author on fruit trees in Bulgaria comprise *Lepidosaphes ulmi*, L., *Epidiaspis leperii*, Sign. (*betulae*, auct.), *Aspidiotus ostreaeformis*, Curt., *A. pyri*, Licht., and *Parlatoria oleae*, Colv., of which the last two have not previously been recorded in the Bulgarian literature. *A. perniciosus*, Comst., was not found. All these Coccids have one generation a year. *A. pyri* and *P. oleae* overwinter as mature females, and *A. ostreaeformis* as a second-instar nymph. *A. pyri* and *E. leperii* prefer pear and damson, and *A. ostreaeformis* sour cherry. *P. oleae* was observed only on apple and pear, and appeared to prefer the fruits. In experiments on control, carried out in the early spring of 1940, a preparation of dinitro-ortho-cresol gave the best results.

Schøyen (T. H.). **Paeregallmyggen.** [The Pear Gall Midge.]—*Norsk Hagetid.* 1940 no. 3 repr. 2 pp., 1 col. pl. Oslo, 1940. (Abstr. in *Z. PflKrankh.* **52** pt. 7–8 p. 426. Stuttgart, 1942.)

During the past 25 years, *Contarinia pyrivora*, Ril., has become injurious to pear in southern Norway, especially on the Oslo Fjord. It attacks all varieties, more especially those that blossom early. This Cecidomyiid is a local pest, occurring year after year in the same place, and spreading very slowly. Trees on grassland suffer more than others, so that the ground, especially under the crowns, should be kept bare. It should be well dug in June and July, as soon as the infested fruits have fallen, and the control is improved by fertilising with kainit or calcium cyanamide at the rate of 900 lb. per acre. In small orchards, adult emergence can be prevented by covering the soil with a layer, an inch thick, of shavings or peat litter soaked in tar distillate. Adult emergence begins when the first flower-buds become visible, and when their stems begin to lengthen, the trees should be drenched with a spray containing nicotine sulphate and soft soap (1 : 10 : 800), which kills the adults before they oviposit. The eggs and larvae can be destroyed by an application made when one-third of the flower buds have opened, followed by another when two-thirds are open.

Schøyen (T. H.). **Frukttremidde og plommeveps.** [The Fruit-tree Mite and the Plum Sawfly.]—*Norsk Hagetid.* 1940 no. 13 repr. 1½ pp. Oslo, 1940. (Abstr. in *Z. PflKrankh.* **52** pt. 7–8 p. 425. Stuttgart, 1942.)

Paratetranychus pilosus, C. & F., which is a serious pest of fruit trees in Norway, cannot be controlled by tar distillates, which do not kill the winter eggs but destroy natural enemies such as *Anthocoris nemorum*, L. [*cf. R.A.E.*, A **17** 501, etc.]. Various mineral-oil emulsions at 8–10 per cent. strength, sprayed until the trees drip, are highly effective, however. It is sometimes necessary to spray in summer with 1–2 per cent. oil emulsions or with lime-sulphur, which kill the summer eggs as well as the later stages, and regular spraying of apple and plum with lime-sulphur as a fungicide may render winter treatment unnecessary [**31** 52]. *Hoplocampa minuta*, Christ, has repeatedly reduced the plum crop in south Norway, early varieties suffering most. An infusion of 3 per cent. quassia [*cf.* **27** 97, etc.] applied immediately before and after blossoming gives good results, but 0·2 per cent. nicotine is almost as effective. Mechanical and chemical treatment of the ground destroys a large proportion of the hibernating larvae.

Husås (O.). **Krusesyke på gulrot.** [The Crinkling of Carrot.]—*Tidsskr. norske Landbr.* 1940 no. 1 repr. 16½ pp. Oslo, 1940. (Abstr. in *Z. PflKrankh.* **52** pt. 7–8 pp. 428–429. Stuttgart, 1942.)

An account is given of investigations on the bionomics, especially the developmental cycle, of *Trioza viridula*, Zett., in Norway, and the spread of the crinkling of carrot caused by the feeding of this Psyllid. Carrots sown early or after 24th June were least attacked. By delaying the date of thinning out the plants, a large proportion of the eggs can be destroyed, but as this causes the plants to shoot up into slender stalks, the value of this measure in practice is doubtful. Repeated top manuring in May and June and watering stimulate growth, so that the plants resist even heavy attack. If cultural measures are inadequate, insecticides must be used. Nicotine sulphate (0·5 per cent.) with 1 per cent. soft soap gave good results in experiments; the spray should be applied on the appearance of the first symptoms of crinkling and repeated 3–4 times at weekly intervals.

Husås (O.). **Ertegallmyggen.** [The Pea Gall-midge.]—*Tidsskr. norske Landbr.* 1940 no. 3 repr. 15 pp. Oslo, 1940. (Abstr. in *Z. PflKrankh.* **52** pt. 7–8 pp. 427–428. Stuttgart, 1942.)

Infestation of peas in Norway by *Contarinia pisi*, Winn., was first reported in 1917, and in 1938 and 1939 this Cecidomyiid caused a crop loss of 25–30 per cent. of field peas in one district. Two generations occurred in southern Norway in 1939. The only parasite bred was the Scelionid, *Sactogaster pisi*, Först. Early sowing and the selection of early varieties are the best preventive measures. After harvesting, the ground should be dug deeply in autumn and new plots should be situated at a distance from old ones ; an even more effective practice would be for a district to grow peas only once in four years. A spray of nicotine sulphate (1 : 400 or 1 : 600) has not proved very effective, but it would be useful if Aphids are also present.

Husås (O.). **Forsøk med frukttrekarbolineum kontra Anti-Krus mot krusesyken og gulrotflua.** [Experiments comparing Fruit-tree Carbolineum and Anti-Krus for the Control of *Trioza viridula* and *Psila rosae*.]—*Tidsskr. norske Landbr.* 1941 no. 1 repr. 12 pp. Oslo, 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 7–8 pp. 425–426. Stuttgart, 1942.)

In experiments in Norway in 1940, a tar-distillate (Mortegg) was compared with another proprietary insecticide for the control of *Trioza viridula*, Zett., and *Psila rosae*, F., on carrot. The crop yield was more than doubled after treatment with tar distillate or the other insecticide at concentrations of 1 and 2 per cent. respectively, and was still further increased when the concentration of tar distillate was 2 per cent. At this concentration, it controlled *P. rosae* as well as *T. viridula* and checked weeds, but it caused some scorching of the carrots. The spray should not be applied until infestation begins to increase, usually in the first half of June, since its action is only temporary.

Schøyen (T. H.). **Melding om skadeinsekter i jord- og hagebruk 1934–1939.** [Report on Insect Pests of Agriculture and Grasslands in 1934–39.]—75 pp. Oslo, 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 7–8 pp. 430–432. Stuttgart, 1942.)

Notes are given on the bionomics and economic importance of insect pests that occurred in Norway in 1934–39. *Charaeas graminis*, L., was very numerous on grassland in northern districts in 1934, in spite of abnormal rainfall. *Contarinia tritici*, Kby., was common on wheat in southern Norway, but not very harmful. During the dry summers of 1935 and 1936, potatoes were attacked, for the first time, by *Cicadella* (*Eupteryx*) *atropunctata*, Goeze. The increase in cultivation of beet was accompanied by increased populations of *Aphis fabae*, Scop., and *Chaetocnema concinna*, Marsh. Pests of crucifers that increased in importance included *Eurydema oleraceum*, L., which was probably favoured by the warm, dry summers in 1936–38 and had not previously been recorded as an important pest, *Ceuthorrhynchus assimilis*, Payk., *Meligethes aeneus*, F., and *Contarinia nasturtii*, Kieff. Serious injury by species of *Phyllotreta*, including *P. atra*, F., and *P. nemorum*, L., caused the cultivation of turnips and swedes to be restricted after 1938–39 in favour of beet. During the whole period, *Trioza viridula*, Zett., was the chief pest of carrots.

In 1939, *Corymbites aeneus*, L., *C. pectinicornis*, L., and *C. sjaelandicus*, Müll. (*tessellatus*, auct.) attacked apple blossoms. *Curculio* (*Balaninus*) *nucum*, L., again oviposited in apples [*cf. R.A.E.*, A **22** 718], probably because hazel had fruited badly, but the larvae were unable to complete their development in them. *Rhynchites cupreus*, L., injured the fruits of apple and plum. Other pests of apple included *Cydia* (*Carpocapsa*) *pomonella*, L., an outbreak of which

occurred in 1934–36, *Chrysoclista* (*Blastodacna*) *putripennella*, Zell., which was numerous in 1933–36, and *Hoplocampa testudinea*, Klug, which is a fairly new pest in Norway and has increased of recent years. *Taeniothrips inconsequens*, Uzel, after being very harmful to pears for many years, has become less injurious, probably owing to regular spraying with nicotine. An account is given of investigations on *Pentatoma rufipes*, L., *Acanthosoma haemorrhoidale*, L., *Lygus pabulinus*, L., and *Calocoris* (*Pycnopterna*) *striata*, L., which attack pears and cause a hardening of the fruit pulp. *Contarinia pyrivora*, Ril., spread further to the west. Infestation of cherries in Norway by *Rhagoletis cerasi*, L., was first observed in 1935 and is now of economic importance in some localities. It is suggested that in Scandinavia this Trypetid has adapted itself to cherry from *Lonicera xylosteum*. *Byturus urbanus*, Lind. (*tomentosus*, auct.) has extended its distribution on raspberry and has been reported from pear blossom. *Batophila* (*Glyptina*) *rubi*, Payk., injured young strawberry leaves, but was readily controlled by derris.

Lists of less important or local pests are appended, together with a brief discussion of insects that are injurious to stored products or are household pests.

Aczél (M.). **Fruit Sawflies.** [*In Magyar with a Summary in German.*]—*Növényegészségüyi Evkönyv* **1** (1937–40) pp. 21–37. (Abstr. in *Z. PflKrankh.* **52** pt. 7–8 p. 426. Stuttgart, 1942.)

During the past 5 years, *Hoplocampa minuta*, Christ, and *H. flava*, L., have been among the most serious pests of plum in Hungary. *H. flava* is stated to predominate in the north and north-east. Its flight peak occurs 3–4 days earlier than that of *H. minuta*. A spray of 3 per cent. quassia infusion has proved the best insecticide, and with the addition of 0·5 per cent. soft soap, it also controls *Hyalopterus arundinis*, F., which is very injurious to plum.

Aczél (M.). *Agrotis c-nigrum* **L. as a Pest.** [*In Magyar and German.*]—*Növényegészségüyi Evkönyv* **1** (1937–40) pp. 134–136. (Abstr. in *Z. PflKrankh.* **52** pt. 7–8 p. 426. Stuttgart, 1942.)

In 1936 the larvae of *Amathes* (*Agrotis*) *c-nigrum*, L., caused serious injury in early spring to grape-vines in Hungary by destroying the buds.

Aczél (M.). **Fliegenlarven zwischen den Wurzeiläusen** (*Pemphigus bursarius* **L.) am Salat.** [Fly Larvae among *P. bursarius* on Lettuce.]—*Növényegészségüyi Evkönyv* **1** (1937–40) repr. 4 pp. (Abstr. in *Z. PflKrankh.* **52** pt. 7–8 p. 428. Stuttgart, 1942.)

Roots of lettuce received in June 1934 from southern Hungary were found to be infested by *Pemphigus bursarius*, L. Larvae of *Thaumatomyia* (*Chlorobisca*) *notata*, Mg., which were numerous, and *C. glabra*, Mg., which were less abundant, were feeding on the Aphids.

Müller (K. O.) & Sellke (K.). **Beiträge zur Frage der Züchtung kartoffelkäferwiderstandsfähiger Kartoffelsorten.** [Contributions to the Question of Breeding Potato Varieties resistant to the Potato Beetle.]—*Z. Pflanzenz.* **24** pp. 186–228. 1941. (Abstr. in *Z. Pflkrankh.* **52** pt. 7–8 p. 427. Stuttgart, 1942.)

A review is given of investigations in France and Germany on the breeding of potato varieties resistant to *Leptinotarsa decemlineata*, Say [*cf. R.A.E.*, A **28** 449, etc.]. It is still uncertain whether toxicity of the foliage is the reason for the resistance of *Solanum demissum*; this decreases as the larvae become older and is only slight as regards the adults. The F_1 generation of hybrids between potato and *S. demissum* is intermediate in resistance between the parents, but resistance was not maintained in the F_2 generation in any strain.

Plantesygdomme i Danmark 1940. [Plant Diseases and Pests in Denmark in 1940.]—*Tidsskr. Planteavl* **46** pp. 495–565. 1942. (Abstr. in *Z. Pfl-Krankh.* **52** pt. 7–8 pp. 429–430. Stuttgart, 1942.)

Insect pests were more abundant than usual in Denmark after the severe winter of 1939–40, when the temperature fell to −27°C. [−16·6°F.], and included species not previously recorded from that country. The woolly apple aphis, *Eriosoma* (*Schizoneura*) *lanigerum*, Hsm., was the only pest reduced in numbers by the cold winter. Insects that caused considerable injury were *Eurydema* (*Strachia*) *oleraceum*, Hahn, and *Phyllotreta* spp. on crucifers, *Lygus pabulinus*, L., on potato, *Calocoris norvegicus*, Gmel. (*bipunctatus*, F.) on beet and swedes, *Thrips angusticeps*, Uzel, on swedes, *Silpha* (*Blitophaga*) *opaca*, L., *Cassida nebulosa*, L., and *Pegomyia hyoscyami*, Panz., on beet, *Agriotes* spp. on grain and root crops, *Biston zonaria*, Rott., on grasses, carrots, swedes and beet, *Charaeas graminis*, L., on meadow grasses, *Nygmia phaeorrhoea*, Don. (*Euproctis chrysorrhoea*, auct.) on fruit trees, and *Amphimallus* (*Rhizotrogus*) *solstitialis*, L., on various cultivated plants. The last-named was parasitised by *Tiphia femorata*, F., which had not been observed in Denmark since 1887. New records included *Psylla pyrisuga*, Först., on apple, *Tortrix* (*Cacoecia*) *costana*, F., on roses in a greenhouse, and *Hadena* (*Mamestra*) *trifolii*, Rott., on beet and swedes.

Feytaud (J.). **Observations on the Colorado Beetle** (*Leptinotarsa decemlineata*) **made in the Bordeaux Region in 1941.**—*Int. Bull. Plant Prot.* **16** no. 6 pp. 85M–86M. Rome, 1942.

As infestation by *Leptinotarsa decemlineata*, Say, was serious in France in 1940 and control measures were carried out less actively than usual, the numbers of adults that entered hibernation in the autumn were large and constituted a serious menace to the potato crops of 1941. In this year, however, weather conditions were unfavourable and control was more vigorous. Damage was more or less mild throughout the south-west of France, but severe in certain parts of north, east and central France ; it was everywhere less serious than damage by potato blight, *Phytophthora infestans*.

In the Bordeaux region, the beetles emerged early from hibernation and were readily found in most fields from the middle of April. Their numbers appeared to decrease during the first fortnight of May, however, and there was little pairing or oviposition, and most of the eggs did not hatch. Larvae of the first generation did not appear until after 15th June, three weeks later than usual, but great heat at the end of June and beginning of July accelerated development, and the adults emerged throughout July. The second generation developed during August, and large numbers of adults appeared during the first fortnight in September. Injury was slight throughout the year in the Bordeaux region, and with the exception of a few foci, populations were so low that repetition of insecticidal treatments was not necessary to save the crop.

Vevai (E. J.). **On the Bionomics of** *Aphidius matricariae* **Hal., a Braconid Parasite of** *Myzus persicae* **Sulz.**—*Parasitology* **34** no. 2 pp. 141–151, 6 figs., 7 refs. London, 1942.

An account is given of laboratory observations in North Wales on the bionomics of *Aphidius matricariae*, Hal., the egg and larva of which are described. This Braconid is an internal parasite of *Myzus persicae*, Sulz., and was also observed to parasitise *M. circumflexus*, Buckt., and *Macrosiphum* (*Aulacorthum*) *solani*, Kalt. *Myzus persicae* was the host on which it was reared for observation. The eggs are generally deposited in the abdomen of the Aphid in the region of the cornicles ; those deposited in the cornicles, legs or antennae failed to hatch. As many as 6–10 eggs may hatch in a host but only one parasite completes its

development, and evidence was obtained that one larva may destroy any others that are present. The larval stage, which includes five instars, is passed in the abdomen of the host. In a heated glasshouse with a temperature of 40–52°F. in winter, parasitised hosts become moribund after 15–28 days. Six hours after the death of the host, the parasite attaches it, by means of silk threads, to any nearby object and pupates. The adult emerges through the dorsal surface of the host. Parasites emerged successfully from 79·84 and 90·60 per cent. of a total of 3,483 apterous and 106 alate hosts, respectively; over 80 per cent. of the adults emerged at night.

Mating takes place from two hours after emergence, but some females refused to pair. Unfertilised females give rise to male progeny only. Single males mated with as many as 18 females, and the progeny from the early matings contained a higher proportion of females than that from the later ones, in which the numbers of males and females were approximately equal. The percentage of Aphids successfully parasitised increased with an increase in the number of insertions of the ovipositor per host. Females laid up to 350 eggs each, and the highest number of adult progeny per female was 309. Most eggs were laid on the second and third days of the oviposition period, which lasted in experiments for up to nine days; there was no evidence of a correlation between oviposition and light intensity. The progeny of a single mated female that was confined under a glass chimney with 25 aphids on tulip eradicated the colony within 11–12 weeks, during which approximately four generations of the parasite were produced. At about 42°F., female parasites under glass chimneys kept out of doors survived for three weeks; activity was reduced at temperatures near freezing point, and oviposition was observed only three times at temperatures below 40°F. A few adults of *A. matricariae* were caught in a mechanical insect trap and the parasite appears to fly readily, its flight being favoured by the conditions favourable to Aphid flight [*R.A.E.*, A **29** 180]. In addition, it is disseminated by the movements of parasitised apterous hosts; in the laboratory, female parasites oviposited in alate Aphids only with difficulty, and only one of 25 alates taken in the field was parasitised. Aphids attacked in the third instar or earlier do not reproduce, but those parasitised in the later stages do so until the parasite larva reaches the third instar.

Cameron (A. E.). **Insect and other Pests of 1940.**—*Trans. Highl. agric. Soc. Scot.* 1941 repr. 21 pp., 17 figs., 6 refs. Edinburgh, 1941. [Recd. December 1942.]

Pieris brassicae, L., was abundant and injurious to cruciferous crops throughout Scotland in 1940 and was accompanied by smaller numbers of *P. rapae*, L., and *P. napi*, L.; *P. napi*, however, occurs chiefly on cruciferous weeds. Both *P. brassicae* and *P. rapae* have pronounced migratory habits, and their abnormal abundance may have been partly due to migration from the Continent. *Ceuthorrhynchus pleurostigma*, Marsh., caused unsightly swellings on the roots of newly transplanted cabbage, and *Brevicoryne brassicae*, L., and *Myzus persicae*, Sulz., were again abundant on cruciferous crops in the Lothians [*cf. R.A.E.*, A **29** 381]. In some localities, beans were practically destroyed by *Aphis fabae*, Scop. *Cavariella aegopodii*, Scop., was fairly prevalent on carrots, but did only slight damage. The larvae of *Psila rosae*, F., *Hylemyia* (*Delia*) *brassicae*, Bch., and *H.* (*D.*) *antiqua*, Mg., infested the roots of carrot, cabbage and onion, respectively.

Potato tubers on newly ploughed grass or waste land were injured by *Hepialus humuli*, L., and the stems by *Hydroecia micacea*, Esp. The adults of the former fly at dusk during June and July, and the female drops its eggs singly over grass or other vegetation. The larvae hatch in about two weeks and begin to feed on rootlets, but may be found on the surface of the ground for some time.

They feed on the roots of grasses, weeds, herbaceous plants or cereals or bore into corms, bulbs, tubers or rhizomes, become full-grown in April or May and pupate in the soil or in burrows in the roots. The larval stage lasts at least two years. Planting in newly ploughed land should be postponed for a year, until the ground is thoroughly cleaned, if possible. In gardens, where strawberry and raspberry, as well as vegetables, may be injured, crude naphthalene should be applied at the rate of 2–3 oz. per sq. yard and thoroughly mixed with the soil at the time of digging. The eggs of *Hydroecia micacea* are normally laid in weedy grassland, and the larvae burrow into the stems of various weeds. In potatoes, they excavate the stems upwards from the soil level ; as many as 10 per cent. of the plants are affected in severe infestations. The only method of control is the removal of infested stems, which become apparent in June, and destruction of the larvae, which are then nearly full-grown. Ground that is continually cropped rarely becomes infested. In June, 3 per cent. of the sugar-beet plants in an area of 1½ acres in Fifeshire were infested by this Noctuid ; most of the larvae were burrowing in the crowns, but some bored into the roots from below. The larvae of *Acherontia atropos*, L., which feed on potato leaves and pupate at a depth of 2–4 ins. in the soil, were more numerous than in recent years. Wireworms and Tipulid larvae damaged cereal and potato crops grown on ploughed grassland, but some of the loss attributed to wireworms was found to be partly or completely due to deficient soil consolidation.

A heavy infestation of *Anomala* (*Phyllopertha*) *horticola*, L., was reported from the shores of Loch Voil, Perthshire, in September, when the larval population was found to be 300 per square yard in a garden lawn. Brief notes are given on the bionomics of this Rutelid and the damage it causes [*cf.* **29** 110] and on methods of control. These comprise shaking the beetles from infested plants on to a sheet spread on the ground, ploughing infested ground to expose the larvae to birds, rolling it in October to consolidate it and crush the larvae, and dressing it just before rain with 2 cwt. crude naphthalene per acre in September or October [*cf.* **23** 631].

Beirne (B. P.). **The Biology and Natural Control of the Larch-shoot Moth, *Argyresthia laevigatella*, H.-S.**—*Econ. Proc. R. Dublin Soc.* **3** no. 10–12 pp. 130–149, 28 figs., 21 refs. Dublin, 1942.

An account, based on investigations in Eire in 1940–41, is given of the bionomics of *Argyresthia laevigatella*, H.-S., which is an injurious pest of larch, and all stages are described. The author considers *A. atmoriella*, Bankes, to be synonymous with *A. laevigatella*, since the distinguishing characters are not constant. In Europe, this Tineid is known to occur in Holland, Germany and the Alpine region, where it is most common, and appears to be as widely distributed as larch in Great Britain and Ireland, where this tree is not indigenous. *Larix decidua* (*europaea*) and *L. kaempferi* (*leptolepis*) are both infested, but damage is more apparent on the former, which has fewer shoots ; it is probable that any species of *Larix* may be attacked.

The eggs are deposited singly on the shoots, generally 2–4 ins. below the tip, during June and hatch in late June or early July. The larva enters the shoot and tunnels downwards below the bark towards the base or tip of the shoot, according to the direction in which it is growing. It overwinters and feeds again in early spring, when it usually eats completely through the wood of the shoot and so kills it. A large and vigorous shoot, such as the leader, however, may not have its wood completely penetrated and may ultimately recover. At the end of April, the larva pupates in a silken cocoon at the bottom of its mine, and the adult emerges at the end of May or the beginning of June. The dead shoots are replaced by one or, in the case of *L. kaempferi*, two side-shoots ; in general, shoots at the side of the tree are more frequently attacked

than those at the top. Infestation is most severe in sheltered plantations, trees and parts of trees, and does not readily spread, owing to the weak flight of the adults.

Insectivorous birds are the most important factor in natural control and destroy about 67 per cent. of the larvae; they are most effective round the edges or in open parts of the plantations and among young trees. About 5 per cent. of the larvae die from unknown causes, about 4 per cent. are killed by Nematodes and fungi, and about 1 per cent. by *Pimpla* (*Ephialtes*) *elegans*, Woldst., which was the only parasite reared during the investigation and of which all stages are described. The eggs of this Ichneumonid are laid singly about the middle of April on the host larvae, which at that time are in their cocoons; two parasite larvae were found on one host and probably developed from eggs laid by two females, and larvae occasionally occurred in host pupae. When fully-grown the larva consumes the entire body-content of its host and pupates in its cocoon. The adults appear about the end of June, and W. E. Stelfox reports that they are also present on larch during the winter. As it is unlikely that the adults survive from June until the following April, it is probable that there is an alternate summer host.

The only available control measure against *A. laevigatella* is the collection and destruction of infested shoots in early spring.

Brown (W. B.) & Higgins (A. E. H.). **The Control of Insects infesting dried Fruits.**—[1+] 2i+3 pp., 8 figs., 4 refs. London, Dep. sci. indust. Res., 1942. Price 6*d*. net.

This pamphlet comprises a brief account of the insects that attack dried fruit in storage, recommendations for general warehouse hygiene, and practical details of the special measures of control required. Although some of the insects attack the growing fruit, infestation is mainly the result of direct or indirect contamination from other infested commodities or premises; dried fruit arriving in Great Britain is most commonly infested with *Ephestia elutella*, Hb., and allied species, *Plodia interpunctella*, Hb., and *Oryzaephilus* (*Silvanus*) *surinamensis*, L., the bionomics of which are briefly described. Other insects that are sometimes important are *Ptinus tectus*, Boield., and *Niptus hololeucus*, Fald., which usually occur in dirty and dusty premises, and *Carpophilus* and *Necrobia*, which are only occasionally very abundant, *Carpophilus* occurring principally on fruit that has begun to ferment. Fruit with a high water content may be attacked by the mite, *Carpoglyphus lactis*, L. (*anonymus*, Haller).

In order to prevent serious infestations, the stock and fabric of the warehouse should be inspected regularly, the premises should be kept clean, the fruit should be fumigated before it is stored, unless it is in airtight packages, the boxes should be sprayed during storage at intervals from about the beginning of May to the beginning of November with a suitable mineral oil containing at least 0·8 per cent. by weight of pyrethrins to prevent re-infestation, and the different commodities should be segregated. Ethylene oxide is considered to be the most suitable fumigant and is used in a mixture containing 10 per cent. carbon dioxide and applied with additional carbon dioxide to reduce the resistance of the insects and remove the danger of explosion. Detailed instructions are given on mechanical and chemical methods of cleaning the warehouse; on the construction and equipment of fumigation chambers, their size and situation, the procedure for fumigating, the dosage of fumigant required and the precautions that must be taken to protect the operators and to prevent fire; and on the equipment required for spraying and the methods and times of application [*cf. R.A.E.*, A **27** 154]. A section on fumigation in barges is included.

PARKIN (E. A.). **Biological Assay of Insecticidal Sprays.**—*Nature* **149** no. 3791 pp. 720–722, 4 refs. London, 1942. **Pyrethrum Sprays.**—*Op. cit.* **150** no. 3795 p. 124. 1942.

The author discusses the use of sprays for the control of insects infesting stored products and particularly of pyrethrum extract in a heavy, highly refined white oil against *Plodia interpunctella*, Hb., and *Ephestia elutella*, Hb., in dried fruit [*cf. R.A.E.*, A **24** 191 ; **27** 154] and the possibility of improving this spray or evolving a more effective one in the light of practical experience and fundamental biological research on the insect cuticle [*cf.* **29** 239 ; **30** 46], and points out that a method of comparing the killing power of different sprays is essential if improvements are to be made. The standard of toxicity can be measured by chemical determination of the pyrethrin content if the insecticide contains only pyrethrum in a specified oil, but a biological assay is required to compare the effectiveness of sprays containing activators or substitutes for pyrethrum.

A specification was drawn up by J. W. Munro and J. C. F. Fryer of a standard spray, consisting of a mixture of an extract of pyrethrum in heavy oil with a similar heavy oil diluent to give a final concentration of 0·8 per cent. pyrethrin I (approximately 1·6 per cent. total pyrethrins), with the addition of 2·5 per cent. by volume of a 10 per cent. solution of pyrocatechol in ether as a stabiliser. A biological test, developed for comparing the film effect [**27** 154] of other sprays with that of the standard, consists in exposing 50 adults of *Tribolium castaneum*, Hbst., when they are 3–5 weeks old, on filter paper to which a measured quantity of the insecticide has been applied in a spray tower, counting the numbers dead after six and nine days and analysing the results statistically. The insects are bred on wholemeal flour kept under standardised conditions at 24°C. [75·2°F.] and 70 per cent. relative humidity and exposed under the same conditions in the dark, and a range of deposits chosen to give 30–90 per cent. mortality after exposures of both six and nine days (about 1·55–2·62 mg. per sq. cm. of the standard spray with the individuals used) is obtained by spraying six or seven papers with increasing deposits, two or three additional deposits at about the mean dosage being made to fix the position of the regression line in the region of 50 per cent. kill. It was necessary to allow the beetles time to recover from the mechanical shock inherent in the method of counting into batches, to pay special attention to the cleanness of all vessels used and to protect them from drifting mists of insecticide. Comparison of insecticides should normally be made on the results obtained after nine days ; experiments have shown that this technique will distinguish the standard spray from a similar one containing 0·65 per cent. pyrethrin I clearly and from one containing 0·7 per cent. in most instances.

In the later note, it is pointed out that the recommendation of a solution of pyrocatechol in ether as a stabiliser applies only to the pyrethrum solution used as a standard comparison in laboratory tests ; a solution of this type, in which ether is employed, would not be suitable for incorporation in a pyrethrum spray for commercial use.

BUSVINE (J. R.). **Relative Toxicity of Insecticides.**—*Nature* **150** no. 3798 pp. 208–209, 6 refs. London, 1942.

The author emphasises the necessity for standard methods of comparing the effectiveness of insecticides, such as that suggested by Parkin [see preceding abstract]. He points out, however, that if more than one toxic principle is investigated, it will be advisable to increase the number of test insects, as any one species may not give a true indication of the effectiveness of a new insecticide [*cf. R.A.E.*, A **26** 633]. The results of tests on the relative toxicity of a variety of fumigants and vapour poisons are shown in tables. Pupae of

Ephestia kuehniella, Zell., adults of *Calandra granaria*, L., and *C. oryzae*, L., larvae of *E. kuehniella* and *Tineola biselliella*, Humm., and adults of *Tribolium castaneum*, Hbst., and *Cimex lectularius*, L., were progressively less resistant to all the fat-solvent vapours tested (benzene, toluene, trichlorethylene, perchlorethylene, carbon tetrachloride and chloroform). They showed a constant, rather different order of relative resistance to the esters, methyl acetate and ethyl acetate, which were not tested on the pupae, *Calandra granaria* being most resistant and *Cimex lectularius* least, but varied considerably in their reactions to the fumigants, ammonia, hydrocyanic acid gas, ethylene oxide and sulphur dioxide, to which *C. lectularius*, *Calandra oryzae*, *T. castaneum* and *C. oryzae*, respectively, were most resistant and *T. castaneum*, *Cimex lectularius*, *Calandra oryzae* and *Cimex lectularius* least. The relative resistance of *Calandra granaria*, *C. oryzae*, *T. castaneum* and *Cimex lectularius* and larvae of *E. kuehniella* to asphyxiation by carbon dioxide was the same as that to the fat-solvent vapours.

The author considers that relative resistance depends on the type of toxic action ; the action of the fat-solvent vapours is mainly physical, whereas the highly toxic fumigants like hydrocyanic acid gas undergo specific chemical reaction in the tissues ; the two esters would be expected to act like the fat-solvent vapours, but are likely to be more readily hydrolysed in the tissues.

Jack (R. W.). **Report of the Division of Entomology** [Southern Rhodesia] **for the Year 1941.**—19 pp. typescript. Salisbury, S. Rhod., 1942.

As in the preceding year [*R.A.E.*, A **30** 160], *Nomadacris septemfasciata*, Serv., was the only locust of which swarms were recorded in Southern Rhodesia, and oviposition was reported from only two districts. Heavy losses resulted from infestation of maize by larvae of the Melolonthid, *Eulepida mashona*, Arr., in two districts, and they also attacked newly-transplanted tobacco in one of them. *Brachytrypes membranaceus*, Dru., was more abundant than usual and caused considerable damage to newly-transplanted tobacco in December. Seedlings of early and main-crop sunn-hemp (*Crotalaria juncea*) sown before the end of December were in many places destroyed by the Galerucids, *Exora apicipennis*, Jac., and *E. discoidalis*, Jac., of which the latter was the more injurious. *Agromyza phaseoli*, Coq., infested cowpeas and beans in March, but was later checked by the Braconid, *Opius liogaster*, Szépl. Cruciferous crops, notably those in market gardens, were severely attacked by *Brevicoryne brassicae*, L., *Myzus persicae*, Sulz., and the larvae of *Plutella maculipennis*, Curt., during the late dry season, and *Bagrada hilaris*, Burm., seriously injured the young plants during August and September. Larvae of *Spodoptera mauritia*, Boisd., which caused extensive damage to lawns in March, were heavily parasitised by *Sturmia instabilis*, Curr.

Infestation of *Citrus* by *Scirtothrips aurantii*, Faure, was heavier than usual, probably owing to lack of rain after the beginning of February ; and this thrips was again injurious to the young leaves of tea in one area [*cf.* **30** 48]. *Ceratitis* (*Pterandrus*) *rubivora* var. *volucris*, Bez., was recorded for the first time in the Colony from a district where it was a major pest of Youngberries. Damage by *C. capitata*, Wied., appeared to be increasing and in one locality resulted in heavy losses to early peach and loquat. The Coccid, *Orthezia insignis*, Dgl., which is a serious pest of the shade trees, *Spathodea* and *Jacaranda*, was also found on the noxious weeds, *Lantana* and *Bidens pilosa*, but appeared to exert little control. Floors constructed of the wood of *Pterocarpus angolensis* in a large number of newly-built houses were seriously infested by the Bostrychid, *Bostrychopsis* sp.

Other pests not mentioned in recent years include *Halotydeus* (*Penthaleus*) *destructor*, Tucker, on late-sown wheat ; *Heliothis armigera*, Hb., on soy bean ; *Alcidodes* (*Alcides*) *leucogrammus*, Erichson, on runner bean ; *Anthores leuconotus*, Pasc., on coffee ; *Chrysomphalus pinnulifer* var. *diversicolor*, Green, and

Heliothrips haemorrhoidalis, Bch., on avocado; *Aspidiotus hederae*, Vall., and *A.* (*Hemiberlesea*) *lataniae*, Sign., on tung tree (*Aleurites*); *Teleonemia australis*, Dist., on olive; *Omophorus stomachosus*, Boh., on cultivated fig; *Isaniris ater*, Mshl., and *Analeurops cuthbertsoni*, Mshl., on young *Eucalyptus botryoides*; *Craspedoxantha marginalis*, Wied., which is recorded for the first time, on *Zinnia*; *Taeniothrips simplex*, Morison, and *Epimadiza hirta*, Mall., on *Gladiolus*, of which the latter is one of the most injurious pests; *Pseudococcus citri*, Risso, on *Hibiscus*; and *Ferrisiana* (*Ferrisia*) *virgata*, Ckll., on *Poinsettia* and other ornamental shrubs.

Mathur (R. N.). **On the Biology of the Noctuidae (Lepidoptera).**—*Indian For. Rec.* (N.S.) Ent. **7** no. 3 pp. 74–154, 1 pl. Delhi, 1942.

This paper comprises notes collected in the course of work at Dehra Dun and from the literature on the biology in India of 134 species of Noctuids, many of which are often serious forest pests and attack a wide range of plants, including cultivated ones, with records of their distribution and of their parasites where these are known, and a catalogue of the food-plants and the Noctuids that defoliate them. The results of observations on the life-history of *Plecoptera reflexa*, Gn., which is an important pest of *Dalbergia sissoo* during the warm season in the irrigated plantations of the Punjab and also attacks *D. latifolia* and *Pterocarpus marsupium*, are given in detail. There are 11 overlapping generations in the year in the Punjab plain, where development was a little more rapid than at Dehra Dun, and the life-cycle appears to last 17–24 days in April–October, 29 days in October–November and about 20 weeks for hibernating individuals. The female deposits up to 400 eggs singly on the leaves at night or early in the morning. The young larvae skeletonise the tender leaves, and the older ones also feed on them; when they are numerous enough to defoliate the trees completely, they also feed on the green pods. The mature larvae crawl or drop to the ground and pupate between dry leaves and rubbish or in the loose soil. Hibernation occurs in the larval and pupal stages. The adults are nocturnal and occasionally fly long distances, carried by wind or in search of young leaves. In captivity they lived less than three days without food, and about a week in summer and 20 days in winter when fed on sweetened water. They first appear in the plains at the end of March and beginning of April, when the first leaves are on the trees. Damage is generally inconspicuous in April, but gradually increases with the population after May, and at this time young trees are completely defoliated. No appreciable damage is done to mature trees. In August and September, during the rainy season, the population is considerably reduced and causes no noticeable injury. Hibernation begins in October. In feeding experiments, development was more rapid and successful on tender leaves than on tough ones. Larvae refused to eat the leaves of eight trees of genera other than those of their recorded food-plants and died within five days.

The population of this Noctuid is reduced by climatic factors, disease, parasites and predators. The primary parasites recorded [*cf. R.A.E.*, A **29** 74, 514] include the Tachinid, *Cnephalia* (*Gonia*) *cinerascens*, Rond. The predators include birds and a variety of insects, but they exercise relatively little control.

Insect Pests.—*Agric. Gaz. N.S.W.* **53** pt. 5 pp. 235–238, 7 figs. Sydney, 1942.

This part of a series on insect pests in New South Wales [*cf. R.A.E.*, A **31** 29] includes notes on the control of *Plutella maculipennis*, Curt., and the Aphids, *Myzus persicae*, Sulz., and *Brevicoryne brassicae*, L., on cabbage. For the control of *P. maculipennis*, cabbages should be dusted every 7–10 days with equal quantities of lead arsenate powder and kaolin during early growth and with derris powder and kaolin (1 : 8) when the plants are hearting [*cf.* **23** 307]. *M. persicae* may be controlled by the use of the derris dust throughout the

season and *B. brassicae*, against which derris is not effective, by the addition of nicotine sulphate to the lead arsenate dust (1 : 16), in which hydrated lime is substituted for kaolin.

SAYLOR (L. W.). **Notes on Beetles related to *Phyllophaga* Harris, with Descriptions of new Genera and Subgenera.** —*Proc. U. S. nat. Mus.* **92** no. 3145 pp. 157–165, 1 pl., 7 refs. Washington, D.C., 1942.

As a result of a study of several hundred species of American MELOLONTHINI that have been referred to the genus *Lachnosterna*, for which he considers *Phyllophaga* to be an earlier name [but *cf. R.A.E.*, A **9** 90], the author divides them into four genera. These are *Lachnosterna* (*Phyllophaga*), which occurs throughout the American Continent but not in the West Indies; *Triodonyx*, gen. n., which comprises *P. gigantissima*, Saylor (the type), *P. lalanza*, Saylor, and *P. ecostata*, Horn; *Cnemarachis*, gen. n. (type *L. vandinei*, Smyth), which includes most of the West Indian species; and *Clemora*, gen. n., which comprises two West Indian species, *Phytalus smithi*, Arr. (the type) and *P. apicalis*, Blanch.

He divides *Lachnosterna* into seven subgenera, including *Listrochelus* (type *L. laportei*, Blanch.) and *Phytalus* (type *Melolontha puberens*, Mannh.), and erects a new subgenus, *Abcrana* (type *Phyllophaga crinitissima*, More) in *Cnemarachis*. Keys are given to these genera and subgenera, and notes are appended on some European and a Philippine species that are comparable with American ones, and on the genus *Holotrichia*. He considers that *Ancylonycha* is an earlier name for *Holotrichia*, that *Brahmina* is congeneric with it, and that it is distinct from *Lachnosterna* (*Phyllophaga*) [*cf.* **9** 89].

BÖVING (A. G.). **Descriptions of the Larvae of some West Indian Melolonthine Beetles and a Key to the known Larvae of the Tribe.**—*Proc. U. S. nat. Mus.* **92** no. 3146 pp. 167–175, 2 pls., 6 refs. Washington, D.C., 1942.

This paper includes descriptions of the mature larvae of the genera *Cnemarachis* and *Clemora*, and of their genotypes *vandinei*, Smyth, and *smithi*, Arr., and brief notes on the characters of some other species of *Cnemarachis*, *Clemora apicalis*, Blanch., and an undetermined species of *Clemora*. A key is given to larvae of MELOLONTHINI from various parts of the world.

O'KANE (W. C.), GLOVER (L. C.) & BLICKLE (R. L.). **An Insect Toximeter. Studies of Contact Insecticides XV.**—*Tech. Bull. N. H. agric. Exp. Sta.* no. 76, 10 pp., 4 figs. Durham, N.H., 1941.

In view of the desirability in investigations on contact insecticides of testing uniform dosages and the difficulty of obtaining even coatings on living insects, the authors devised a spray chamber in which a stand on which the insects are suspended by means of wire clips is placed on a pedestal centred on a turn-table at the junction of two columns of spray, atomised by artist's air-brushes, one of which discharges upwards and the other downwards at angles of approximately 45°. Insects feeding on small potted plants can be treated by putting the plant on the turn-table in the position normally occupied by the stand. The apparatus and methods of adjusting and using it are described in detail.

WILSON (J. W.). **Correlation of Sugar Yields with the Percent of Joints bored by *Diatraea saccharalis* (F.). Sugarcane Borer Studies —I.**—*Florida Ent.* **25** no. 2 pp. 19–24, 1 graph, 6 refs. Gainesville, Fla., 1942.

The percentage of sugar-cane internodes injured externally by larvae of *Diatraea saccharalis*, F., is closely correlated with the percentage bored internally [*cf. R.A.E.*, A **30** 117] and can thus be used as a guide to the abundance

of the Pyralid, but its relation to the loss of sugar due to infestation has not been investigated. Such an estimate would be useful in the Everglades district of Florida, where the average percentage of bored internodes is low. The investigations described were carried out with the varieties F31–962, POJ 2725 and F31–436, which are the principal ones grown in the district, and involved the analysis of 108 samples, each comprising 10 full-length canes, classified according to the percentage (0, 5–10, 10–15, 15–20 and over 20) of internodes injured externally. It was found that, with the exception of one sample, the number of pounds of 96° sugar per ton of cane decreased progressively with an increase in the percentage of bored joints. When all varieties were considered together, the average loss between infested cane of one class and that of the next was practially constant (7 lb. per ton), and this difference was also constant (10 lb.) in F31–962, which is a small-barrelled early variety with more than 12 per cent. fibre. In POJ 2725 and F31–436, which are large-barrelled late varieties with less than 10 per cent. fibre, losses were not constant, but the amount of sugar lost when the percentage injury was over 20 was almost twice as great as when it was 15–20. The highest losses occurred in F31–962, and the lowest in POJ 2725.

In a discussion of the monetary loss represented in the samples, it is stated that where first-generation larvae can be sufficiently reduced by means of insecticides, this measure is economically practicable even when the percentage of bored internodes is as low as 5–10. J. W. Ingram and A. L. Dugas found that populations of first-generation larvae were reduced by 92–97 per cent. following four applications of cryolite dust at weekly intervals [*cf.* **30** 413].

BERGER (E. W.). **Status of the friendly Fungus Parasites of armored Scale-insects.**—*Florida Ent.* **25** no. 2 pp. 26–29, 4 refs. Gainesville, Fla., 1942.

The author quotes from and discusses bulletins published in Florida in 1897 and 1908 on entomogenous fungi that attack Coccids on *Citrus*. Those dealt with are the red-headed scale-fungus, *Sphaerostilbe aurantiicola*, which was formerly known as *S. coccophila*, the white-headed scale-fungus [*Podonectria coccicola*] and the black scale-fungus, *Myriangium duriaei*. The pink scale-fungus, *Nectria diploa*, is not treated as distinct from *S. aurantiicola*, since some mycologists consider it to be a form of the latter. *S. aurantiicola* occurs in many countries, but is considered to be indigenous in Florida since it attacks the native *Chrysomphalus obscurus*, Comst. It is very effective against the San José scale [*Aspidiotus perniciosus*, Comst.], and is easily transferred to trees infested by this Coccid. It can destroy large numbers of Coccids without any external sign of its presence; W. B. Tisdale states that fruiting bodies are produced on the lower surfaces of leaves that are displaced so that they are exposed to a stronger light than usual, and a strong light also appears to be necessary for the production of fruiting bodies by the brown whitefly fungus, *Aegerita webberi*.

Podonectria coccicola is believed to have been largely responsible for checking a severe outbreak of the long scale [*Lepidosaphes gloveri*, Pack.] early in the nineteenth century when this Coccid was imported into Florida with *Citrus* and caused very serious losses. It was also the dominant fungus attacking *L. gloveri* and the purple scale [*L. beckii*, Newm.] about the end of the century, but it is not thought to be native to Florida since it has not been observed on indigenous Coccids. *S. aurantiicola* was probably also instrumental in checking *L. gloveri*, once its migration from native Coccids to those on *Citrus* had occurred. The status of *Myriangium duriaei* as a parasite of Coccids has not changed, so far as the author is aware. It is effective [*cf. R.A.E.*, A **22** 182], but adheres to the fruits when they are being prepared for the market.

SMITH (H. S.). **Biological Control of the Black Scale.**—*Calif. Citrogr.* **27** no. 10 pp. 266, 290–291, 8 figs., 2 refs. Los Angeles, Calif., 1942.

From a survey of the counties in southern California in which the black scale [*Saissetia oleae*, Bern.] was previously a major pest of *Citrus* and from reports by entomologists and other officials, the author concludes that infestation in the coastal area was the lowest for many seasons in 1941 and 1942, in spite of unusually favourable weather conditions, and almost no insecticidal treatment was needed. In inland areas there were a few medium to heavy infestations with many heavily infested groves in one locality. He considers that this change in the status of *S. oleae* has been principally due to the establishment of *Metaphycus helvolus*, Comp. [*cf. R.A.E.*, A **28** 533; **29** 386]. Adults of this Encyrtid survive for long periods (more than eight months in one instance), have great powers of searching and dispersal, as indicated by their general occurrence in all localities in southern California within three years of their introduction, are capable of depositing an average of 400 eggs per female, with an observed maximum of 740, and destroy large numbers of the Coccids by feeding on them. Experiments to measure the quantitative effect of *M. helvolus* on the development of *S. oleae* were carried out, using closed and open organdie sleeves (to exclude or admit the parasites) on branches that had been treated with an insecticide and then infested with crawlers of *S. oleae* in the autumn. As shown on graphs, the approximate numbers of scales on 50 leaves and 50 five-inch twigs were reduced from some 3,500 in September to 2,500 in closed sleeves and 250 in open ones in April in one locality, and from about 2,000 in September to 1,000 and 100 in April in another, parasitism reaching nearly 50 per cent. in the first locality and over 75 per cent. in the second. The results of a further experiment, in which one of two enclosed infested branches was stocked with 20 females of *M. helvolus*, and counts of live scales and of parasitised ones were made each month, indicated that feeding by the adult parasites is the chief cause of mortality during the winter, when the scales are small and numerous, but that parasitism becomes the dominant cause later in the year, as the scales become larger.

In discussing the relative lack of control obtained in certain inland areas, the author points out that in these places there are practically no crawlers from about 10th April to 15th July, and there is probably a high mortality of adult parasites during this period, which would be accentuated by any additional unfavourable conditions.

MCGREGOR (E. A.). **Recently discovered Mite on** *Citrus*.—*Calif. Citrogr.* **27** no. 10 p. 270, 5 figs., 1 ref. Los Angeles, Calif., 1942.

During the summer of 1937, crinkled and pitted lemon leaves in an orchard near La Habra, California, were found to be infested with a species of *Tarsonemus* subsequently identified as *T. bakeri*, Ewing. The mites were feeding within the bracts of the buds at the base of the leaf stems, causing the tips of the buds to die; as many as 44 per cent. of the buds were infested and frequently 10–30 per cent. were injured. Later surveys in a large number of orchards in southern California showed that 10–100 per cent. of the small fruits bore this mite in the space between the inner base of the calyx cup and the outer rim of the "button" from which the fruit arises. In addition to disfiguring the leaves, their feeding results in stunted buds and, in heavy infestations, in rough and deformed fruits, which tend to drop from the trees. They seem to be closely associated with *Alternaria*, which is known to be the direct or contributing cause of various types of rot, and may possibly spread this fungus. *T. bakeri* has been observed on Eureka and Lisbon lemons, navel and Valencia oranges and grapefruit and has been found in *Citrus* orchards in six counties in California. It occurred on the same trees as *Eriophyes sheldoni*, Ewing, in some orchards in San Diego County.

Patch (L. H.), Holbert (J. R.) & Everly (R. T.). **Strains of Field Corn resistant to the Survival of the European Corn Borer.**—*Tech. Bull. U. S. Dep. Agric.* no. 823, 21 pp., 10 refs. Washington, D.C., 1942.

These investigations on the control of *Pyrausta nubilalis*, Hb., on maize by the use of resistant strains were carried out in Ohio in 1930–39, to show the relative resistance to borer survival contributed by inbred lines of field maize to hybrid combinations, the relative resistance being measured as the percentage deviation of the observed population of borers from the predicted population on the date of silking of the strain of maize. In the earlier years when 24–36 strains were tested each year at several levels of borer population, certain hybrids showed a decided resistance to borer survival and others a marked susceptibility, and these were later used as standards for comparison. In 1938, more than 200 top-cross strains and in 1939 more than 100 single- and top-crosses were tested. Each test plot contained six plants, which were infested by hand with numbers of eggs (120–180 per plant) large enough to subordinate any possible effect of the difference in the numbers of eggs laid by free moths between the strains, in order to ensure reliable comparison among the strains of the numbers of borers surviving. It was found that the inbred lines varied in their inherent resistance to the survival of *P. nubilalis* and that the factors responsible for this resistance are transmitted to the hybrids into which these inbred strains enter as parents. It appears that resistance is the result of an undetermined number of multiple factors, that strains showing the greatest degree of resistance contain the largest number of these factors, whether dominant or recessive, and, conversely, the inbred lines showing susceptibility or the least degree of resistance to the borer contain the smallest number of these factors, and that between these two extremes there is a wide range of inbred strains exhibiting various degrees of resistance. Tests of ten open-pollinated varieties during six seasons showed that, as a group, they were nearly as susceptible to *P. nubilalis* as any strain studied.

Cotton (R. T.). **Control of Insects attacking Grain in Farm Storage.**—*Frmrs' Bull. U. S. Dep. Agric.* no. 1811 (revd.), 24 pp., 21 figs., 1 ref. Washington, D.C., 1942.

In this revision of an earlier bulletin [*cf. R.A.E.*, A **27** 341], brief notes are given on two additional pests, *Plodia interpunctella*, Hb., the larvae of which occur chiefly in the top 12–16 ins. of stored grain, though they are sometimes found at much greater depths in bins of maize, and are parasitised by *Microbracon hebetor*, Say, which often becomes very abundant during outbreaks of the moth and effectually controls it, and *Rhizopertha dominica*, F., which causes serious damage to grain stored in terminal elevators and is found occasionally in farm-stored grain as far north as Oklahoma and Kansas, but is not yet a serious pest of such grain in the main growing regions of the United States. The development of infestation in the field, other sources of infestation and the regional abundance of the different species are discussed and preventive measures that should be begun on the farm described, including the care and preparation of the requisite farm structures and the storage of none but clean whole grain of low-moisture content, together with protective measures such as the mechanical handling of the grain, the addition of inert dusts to retard development of the pests or of poison dusts (to seed grain only) and fumigation. The use of carbon bisulphide alone as a fumigant is no longer recommended, owing to the danger of fire, and it is emphasised that the operator should avoid spilling any mixture containing carbon tetrachloride on the clothing or hands or inhaling the vapour. The dosages recommended for the mixtures of carbon bisulphide and carbon tetrachloride (1 : 4) and of ethylene dichloride and carbon tetrachloride (3 : 1) are increased to 6 U.S. gals per 1,000 bushels grain

[*cf.* **29** 429] in a well-constructed bin. It has recently been found that when 10 per cent. by volume of methyl bromide is added to the latter mixture, the dosage can be reduced to 2 U.S. gals. without loss of effectiveness, but the mixture is highly poisonous to man. The surface of shelled maize stored in metal bins can be sprayed with 2 U.S. quarts refined oil (viscosity 100–200 secs. Saybolt at 100°F.) per 1,000 bushels grain to reduce reinfestation after fumigation.

WHITTEN (R. R.). **Toxic and repellent Sprays for the Control of Elm Bark Beetles.**—*Circ. U. S. Dep. Agric.* no. 647, 12 pp., 2 figs., 5 refs. Washington, D.C., 1942.

An account is given of experiments carried out in 1939–41 on the control of *Scolytus multistriatus*, Marsh., and *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh., the chief vectors in the United States of the fungus [*Ceratostomella ulmi*] causing Dutch elm disease, by spraying elm logs with toxic or repellent agents in light oils (26–45°Bé.) or emulsified in water. The oil sprays contained crude orthodichlorobenzene alone or with naphthalene or a chlorinated naphthalene sold as monochloronaphthalene, monochloronaphthalene alone, naphthalene dissolved in xylene, pentachlorophenol dissolved in acetone or in toluene, or diphenyl with pentachlorophenol, in toluene. The water emulsions contained orthodichlorobenzene or a solution of naphthalene in xylene with suitable emulsifiers. In laboratory tests, all the spray combinations tested gave good control when applied to infested logs. The tests with orthodichlorobenzene in oil (1 : 4), monochloronaphthalene in oil (1 : 4) and orthodichlorobenzene in water with an emulsifier (946 : 3,785 : 50) were repeated sufficiently to give significant results, and these three formulae reduced emergence by 98·5–100, 93·4–100 and 87·3–100 per cent., respectively. The first four combinations and orthodichlorobenzene in water were tested for their repellent effect. When applied to uninfested logs, which were exposed to weathering for 7–46 weeks and to attack by large populations of the bark-beetles for 4–20 weeks, they reduced the average number of normal galleries per log by 75–100 per. cent.

In field tests in which piles of freshly cut logs were exposed to attack by both species throughout the season, orthodichlorobenzene in oil (1 : 4) and monochloronaphthalene in oil (1 : 8), applied as repellents immediately after staking, reduced the emergence per sq. ft. by 96·7 and 99·3 per cent. and the number of egg galleries per sq. ft. by 90·6 and 98·9 per cent., respectively, and the sprays of orthodichlorobenzene in oil and in water, applied as toxic sprays after six weeks of bark beetle attack, reduced the emergence per sq. ft. by 90·7 and 67·1 per cent. and the emergence per egg gallery by 86 and 57·7 per cent., respectively. There was little difference between the amount of attack or of control at the ends or in the central sections of the logs ; the lower effectiveness of the toxic sprays was probably due to lack of coverage, and that of the water emulsion to washing off by rain. The sprays were used at the rate of 2·45–3 U.S. gals. per 604–775 sq. ft. bark surface. The results obtained were best when the air temperature was above 50°F. ; they were not affected by bark moisture ranging from 30 to 139 per cent. or by the age of the brood of bark-beetles. Repellent sprays were found to be effective for the entire active season.

WEBSTER (R. L.) & others. **Division of Entomology.**—*Bull. Wash. agric. Exp. Sta.* no. 410 (51st Rep. 1940–41) pp. 43–49. Pullman, Wash., 1941. [Recd. December 1942.]

In tests of sprays against the codling moth [*Cydia pomonella*, L.] on apple in Washington in 1940–41, the control given by phenothiazine and soap was

outstanding in comparison with that by lead arsenate and oil when the micronised material was used, but poor results were obtained with the regular milled material. Micronised phenothiazine, however, caused more injury to the plants. Genicide (xanthone) gave only moderate control and caused foliage and calyx injury when applied in the fourth cover spray after second and third cover sprays containing lead arsenate and 0·5 per cent. oil [*cf. R.A.E.*, A **29** 640]. In insectary studies in which light oils (50–65 secs. Saybolt viscosity), which are used instead of medium and light-medium oils in combination with lead arsenate to avoid foliage injury and residues, were applied to eggs of *C. pomonella* on apples, concentrations as low as 0·5 per cent. gave 90 per cent. control; lower concentrations were ineffective. *Tetranychus pacificus*, McG., was less abundant than usual on fruit trees in the Wenatchee area in May and June 1941, but early spring infestations developed in the Leavenworth-Peshastin district. Light mineral oils at concentrations of 0·75–1 per cent. actual oil gave consistently good control of mites and eggs; highly refined oils (90-92 per cent. unsulphonatable residue) are desirable; injury to fruit resulted from the use of one oil with 82 per cent. unsulphonatable residue. When the mite population is increasing, two applications with an interval of 10 days are usually required for control. Sulphurs, saponin, α-chloronaphthalene and tartar emetic were unsatisfactory. In limited tests, dilute combinations of lime-sulphur and oil gave promising results against *Eriophyes pyri*, Pgst., on pear; a spray containing 3 per cent. lime-sulphur and 1 per cent. oil was as effective as one containing 10 per cent. lime-sulphur. Observations during March and April failed to show that this mite caused russeting of the fruits early in the season. The addition of 1 per cent. mineral oil to dilute sprays of lime-sulphur greatly increased the mortality of San José scale [*Aspidiotus perniciosus*, Comst.], but a commercial wetting agent increased the efficiency of 3 or 10 per cent. lime-sulphur by only 2 per cent. Elemental sulphur gave 36 per cent. mortality alone and 95 per cent. when 1 per cent. oil was added. Dilute lime-sulphur with oil gave unsatisfactory results when applied to cherry trees in western Washington during the dormant season against *Lecanium coryli*, L.

Sprays of 2 lb. lead or calcium arsenate, Paris green or cryolite per 100 U.S. gals. water, dusts containing 10 or 33 per cent. of these materials in pyrophyllite, pyrethrum dusts (0·1–0·2 per cent. pyrethrins) and commercial rotenone dusts (0·5–1 per cent. rotenone) all resulted in practically complete mortality of *Crioceris asparagi*, L., on asparagus three days after treatment; the dusts were applied at about 25 lb. per acre. Large numbers of adults of *Agromyza simplex*, Lw., were observed in all the asparagus fields examined over a large area in the south-east of the State, and mines in the stalks were very noticeable in the same fields after 1st July. The flies apparently prefer to oviposit in developing stalks rather than mature ones; the eggs are laid in them near or below the ground, and the larvae may destroy the cortex for 2–3 ins. above and below ground level, without, however, appearing to damage the plant. There are two generations of both *Epitrix cucumeris*, Harr., and *E. subcrinita*, Lec., during the season, and larvae of the former sometimes cause severe injury to potato tubers late in the year. The relative abundance of the two species varies in different potato fields, but *E. cucumeris* was always by far the more numerous when tuber damage was severe. Larvae of *E. subcrinita* were found feeding on the roots of common nightshade (*Solanum nigrum*) and on belladonna [*Atropa belladonna*]. Although scattered reports were received during the summer of honey bees poisoned by the dusts on potato fields, bees were almost completely absent from the fields unless they were attracted to sweet clover growing there [*cf.* **31** 29].

The percentage infestation of sweet maize by *Heliothis armigera*, Hb., was 18 early in the season, 80-90 by mid-season and practically 100 at the end of the season. The injection of mineral oils (ranging from 100 to 300 secs. viscosity and

from 94 per cent. unsulphonatable residue to U.S.P.) into the tips of the ears at the rate of 0·6–1·3 cc. per ear was unsatisfactory, as when treatment was applied 12–14 days before harvest the kernels near the tip of the cob failed to develop and when it was delayed till 10 days before harvest the larvae had already damaged the ears ; the practicability of this method under Washington conditions is doubtful. The addition of dinitro-ortho-cyclohexylphenol to the oil gave good control but caused severe rotting of the ear tip at 0·05 oz. per U.S. gal. and poor control, but no rotting, at 0·01 oz. per U.S. gal. Oil containing phenothiazine (1 or 5 oz. per U.S. gal.), dichlorethyl ether (2 per cent.) or pyrethrum extract (0·2 per cent. pyrethrins) did not give promising results.

Laboratory and greenhouse experiments, reported by R. D. Eichmann, showed that a spray containing 1–1½ lb. tartar emetic and 3 lb. white sugar per 100 U.S. gals. water gives control of onion thrips [*Thrips tabaci*, Lind.] and gladiolus thrips [*Taeniothrips simplex*, Morison] on carnation comparable with that obtained with the previously recommended formula of 2 lb. tartar emetic, and 4 lb. brown sugar per 100 U.S. gals. The reduction in quantities decreases the risk of spray injury, particularly if application is made at the rate of only 1 U.S. gal. per 200–400 sq. ft. of carnation bench space ; in greenhouse tests, sprays were applied three times in autumn and five or six times in spring at intervals of about three weeks.

Overholser (E. L.) & others. **Division of Horticulture.**—*Bull. Wash. agric. Exp. Sta.* no. 410 (51st Rep. 1940–41) pp. 55–82. Pullman, Wash., 1941. [Recd. December 1942.]

In a section dealing with spray injury to apple trees in Washington (pp. 63–64), it is reported that in early summer, when the interval between sprays was 10 days or less, sprays of lead arsenate and light summer oils (60 secs. viscosity, 80 or 92 per cent. unsulphonatable residue) or of cryolite and the second oil materially reduced the amount of carbon dioxide taken in by the leaves, but towards the end of the season, when the interval between sprays was 15–30 days, the sprayed leaves functioned as well as unsprayed ones. In the Wenatchee district, severe injury occurred on the foliage of weak trees during July when oil sprays were applied on days when the temperature exceeded 95°F. ; and owing to unusually high humidity and considerable rainy weather during August and early September, severe arsenic injury to foliage occurred in many orchards. Arsenic injury was also severe when the spray lines and spray tanks were not adequately drained and washed out between sprays. In experiments to determine what proportion of soluble arsenic in the spray would cause plant injury, more than 16 mg. per litre (1·56 per cent. of the total arsenic in a mixture of 3 lb. lead arsenate per 100 U.S. gals) caused slight injury to the foliage of three varieties and 128 and 513 mg. per litre caused severe leaf scorch and defoliation, but even the higher amounts of soluble arsenic resulted in no fruit injury.

Dormant oil with lime-sulphur, applied when the buds were dormant, caused no injury except when the oil was not properly emulsified. Severe injury, amounting in some cases to the complete loss of the crop, occurred when a broken emulsion of 4 per cent. dormant oil was applied to the Winesap variety as a delayed dormant spray. Lime-sulphur and oil caused no injury when applied experimentally at the delayed dormant stage, but destroyed 90–100 per cent. of the bloom when used just before the pre-pink stage. A commercial oil-pyrethrum spray (Pyrocide), applied to the trunks of Delicious trees in December 1940 and March 1941 to kill hibernating larvae of *Cydia pomonella* resulted in severe trunk injury by June and October, respectively, and severe pre-harvest fruit drop and premature leaf-fall were recorded from all the treated trees.

CROWLEY (D. J.). **Cranberry Blueberry Laboratory.**—*Bull. Wash. agric. Exp. Sta.* no. 410 (51st Rep. 1940–41) pp. 119–121. Pullman, Wash., 1941. [Recd. December 1942.]

In further experiments carried out on cranberry heavily infested by San José scale [*Aspidiotus perniciosus*, Comst.] in Washington in 1941 [*cf. R.A.E.*, A **29** 642], the use of dormant sprays containing 10 gals. liquid lime-sulphur, or 3 gals. liquid lime-sulphur and 1 gal. oil (60 secs. viscosity), per 100 gals. water resulted in 99·5 per cent. uninfested fruit, and one containing 15 lb. dry lime-sulphur and 1 U.S. gal. oil per 100 U.S. gals. water in 98·8 per cent., as compared with 21 per cent. on unsprayed plants. No commercial injury resulted from the sprays, though the sprayed plants did not flower until a week later than the others. The combinations of oil and lime-sulphur were more economical than the standard lime-sulphur sprays. The cranberry tipworm [*Dasyneura vaccinii*, Smith] caused considerable injury in two districts by feeding in the tips of the new growth. When the tips are injured late in the season by the second-generation larvae, no fruit buds are set for the next season's crop ; such injury occurred in a few of the bogs. Preliminary tests indicated that *D. vaccinii* can be controlled by rotenone sprays. In field experiments to compare the effectiveness of various commercial rotenone sprays, a higher kill of both fireworm [*Rhopobota naevana*, Hb.] and fruitworm [*Mineola vaccinii*, Ril.] was obtained when the rotenone was in solution than when it was in suspension ; a combination of rotenone and pyrethrum gave better control of both species than either material alone.

PAUL (L. C.). **A dry Bait for Grasshopper Control.**—*Canad. Ent.* **74** no. 5 pp. 77–78. Guelph, Ont., 1942.

Parallel tests on field plots and in field cages with the standard and with dry baits against *Camnula pellucida*, Scud., and *Melanoplus mexicanus*, Sauss., in Saskatchewan and Manitoba produced practically identical results, the mean difference in favour of the standard bait being 0·72 per cent. The dry bait was prepared by spraying a solution of sodium arsenite, containing the equivalent of 8 lb. As_2O_3 per gal., directly on dry bran, at the rate of 1 quart per 100 lb. By using a spray gun that worked at an air pressure of 40 lb., it was possible to distribute the syrup-like concentrated solution in a fine mist. The formation of droplets of fluid on the walls of the apparatus was almost entirely prevented by spraying the solution into the air stream that carried the bran, just as the bran entered a large box receptacle, in which a fan was placed to ensure better mixing. The dry bran did not lump or mould for several weeks. Further development of its use is urged, particularly for distribution from aircraft.

WALLACE (P. P.) & BEARD (R. L.). **Larval Characteristics of certain Elm Bark infesting Coleoptera.**—*Canad. Ent.* **74** no. 5 pp. 86–87, 3 figs., 4 refs. Guelph, Ont., 1942.

It is often difficult to identify species of Coleopterous larvae that commonly occur in the bark of decadent elms, unless they can be positively associated with their maternal egg galleries ; it is practically impossible to distinguish the larvae of *Magdalis armicollis*, Say, and *M. barbita*, Say, but certain constant larval characters that differentiate *Magdalis* spp., *Scolytus multistriatus*, Marsh., and *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh., and can be used in the field are given. The larvae of *S. sulcatus*, Lec., are larger than those of *S. multistriatus* when fully developed, but are otherwise indistinguishable ; they produce larger

larval tunnels and deeper sapwood engraving, however, and if these are found, adults should be examined. In countries where *S. scolytus*, F., occurs, the much larger size of the mature larvae may assist identification.

GORHAM (R. P.). *Rhamnus alnifolia* **L'Hér., a Winter Host of** *Aphis abbreviata* **Patch, one of the Aphids feeding upon Potato Foliage.**—*Canad. Ent.* **74** no. 5 p. 96. Guelph, Ont., 1942.

As *Aphis rhamni*, Boy. (*abbreviata*, Patch) is more widely distributed in New Brunswick than *Rhamnus cathartica*, on which it is known to oviposit in autumn, a search was made for *R. alnifolia*, which is a common winter food-plant in Maine [*cf. R.A.E.*, A **14** 256] and was recorded in three localities in New Brunswick in 1885, but not since. In late September, this shrub was found to be moderately abundant in wet pastureland in Victoria County, and migrants of *A. rhamni* were clustered thickly on the leaves and stems and beginning to oviposit ; in late October, the plants bore large numbers of eggs. Potatoes grown within 500 ft. of some of these plants had suffered one of the most severe infestations of this Aphid seen for many years in August. *R. frangula*, a European hedge plant recently introduced into York County, was also found to be a winter food-plant of this Aphid.

PAPERS NOTICED BY TITLE ONLY.

[RODIONOV (Z. S.).] **Родионов (З. С.). Conditions for a Mass Development of Grain Mites.** [*In Russian.*]—*Uchen. Zap. mosk. gosud. Univ.* no. 42 Zool. pp. 227–260, 9 figs., 3 graphs, 30 refs. Moscow, 1940. (With a Summary in English.) [Recd. December 1942.] [See *R.A.E.*, A **26** 96.]

[RODIONOV (Z. S.).] **Родионов (З. С.). On the Habitats and the Spreading of Grain Mites.** [*In Russian.*]—*Uchen. Zap. mosk. gosud. Univ.* no. 42 Zool. pp. 261–269, 1 fig., 8 refs. Moscow, 1940. (With a Summary in English.) [Recd. December 1942.] [See *R.A.E.*, A **27** 551.]

VAPPULA (N. A.). **Finnish Entomological Literature published in 1940 including** [42 titles on] **Economic Entomology and Control of Insect Pests.**—*Ann. ent. fenn.* **7** 15 pp. 1941. (Abstr. in *Z. PflKrankh.* **52** pt. 7–8 p. 427. Stuttgart, 1942.)

KEY (K. H. L.). **Investigations on the Locust (Grasshopper) Problem** [in Australia].—*J. Coun. sci. industr. Res. Aust.* **15** no. 1 pp. 72–77. Melbourne, 1942. [*Cf. R.A.E.*, A **26** 583 ; **27** 545 ; **29** 141 ; **30** 420.]

Spraying Program and Pest Control for Fruit Crops [in Ohio].—*Bull. Ohio agric. Exp. Sta.* no. 599 (revd.), 63 pp., 44 figs. Wooster, Ohio, 1942. [Revision of previous Bulletin : *R.A.E.*, A **20** 466.]

KEARNS (H. G. H.) & MARSH (R. W.). **A Summary of Fruit Spraying Programmes** [in south-western England]. **1942 Revision.**—*Rep. agric. hort. Res. Sta. Bristol 1941* pp. 59–69. Bristol [1942]. [*Cf. R.A.E.*, A **25** 708.]

ZUKEL (J. W.). **The insecticidal Action of Phenothiazine** [on *Periplaneta americana*, L.].—*Science* **96** no. 2495 p. 388, 4 refs. Lancaster, Pa., 1942. [See *R.A.E.*, B **31** 33.]

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